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THE JOURNAL OF NEUROLOGY AND PSYCHOPATHOLOGY

Vol. XIII. OCTOBER, 1932. No. 50.

Original Papers.

BRAIN STRUCTURE IN RELATION TO THE MIND.

Illustrated by new and original models.

By

RICHARD J. A. BERRY, Bristol.*

It is a widespread belief that the phenomena of the human mind are too complex to admit of their structural explanation or understanding. This belief is, however, only partially true, and overlooks much detailed and recent study of the nervous system, both in medical and biological science. This work is not usually accessible to the medical profession, and is published in technical and other works appertaining to embryology, human and comparative anatomy, neurophysiology and pathology, cyto-architectonics, etc., hence there is a natural failure to realize the progress which has recently been made in our understanding of the actual relationship between cortical brain-cells and mind. The new and original models to be illustrated to-night are an attempt to demonstrate this relationship in an ocular and understandable manner.

It will be generally admitted that current methods of teaching the anatomy and physiology of the nervous system are but little concerned with the relationship of brain-cells to mind. It is, therefore, necessary to

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approach the problem in a new way and to proceed from the simple to the complex. The first model to be described will thus be one familiar to all medical men—a simple spinal cord reflex, such as actuates the well-known phenomenon of the knee-jerk and, incidentally, also illustrates the fundamental principles of the nervous system of all vertebrates.

A SIMPLE SEGMENTAL THREE NEURONED REFLEX ARC (fig. 1).

The three structural nerve elements here concerned are (1) a receiving neuron, (2) a connectant neuron, and (3) an effector neuron. Each nerve element is entirely disconnected from the next in sequence, and the potential break between the elements is technically termed a *synapse*—a fact of considerable significance in the phenomena of normal and abnormal nerve conduction. As the nervous system is everywhere built up and compounded of such neurons in arcs and chains, it is important, if the relation of brain structure to mind is to be understood, that these elementary principles shall be constantly borne in mind.

The first or receiving neuron in the illustrative model is more generally known in medical practice as afferent or sensory.

The second or connectant neuron is almost invariably entirely overlooked, and yet it is the key to the problem.

The third or effector neuron is commonly known as the efferent or motor neuron.

In accordance with modern neurological thought it would be to the advantage of clinical medicine, and would certainly help to a better understanding of the relationship of brain structure to mind, were these obsolescent terms of ' afferent or sensory,' and ' efferent or motor,' dropped from medical literature and usage, and their simpler physiological substitutes—receptor and effector—employed. In the still more difficult study of brain structure in relation to mind, the terms *receptor* and *effector* are definitely preferable. The term receptor, as applied to such neurons, implies that they receive something. What then do they receive? Such neurons receive, and transmit centrally, impulses generated within them in response to stimuli, and these stimuli may be chemical, mechanical, or physical. The organs which respond to these stimuli form the ' senses ' of the animal, and these senses differ in their numbers, nature, and intensity in different animals, according to their environmental requirements. Thus man, popularly believed to possess but five senses, has in reality about twenty-five such special receptor organs, which respond to the appropriate stimuli and so induce the corresponding receptor neurons to generate and transmit centrally induced nerve impulses.

These elementary principles are easily studied in figure 1. Here the receptor organ responds to a mechanical stimulus—the tap on the infra-

patellar tendon—and thereby induces the bipolar receptor neuron to generate and transmit an impulse centrally. The second, connectant or internuncial, neuron is stimulated in its turn, and so the nerve impulse bridges the synapse between it and the outgoing effector neuron, thus causing the latter to generate and discharge nerve impulse to the appropriate effector organ—in this case the quadriceps extensor muscle, which contracts slightly and so produces the knee-jerk.

The response to the original stimulus is thus immediate, inevitable, and invariable. In such a type of neuronic arc there is no appreciable interval

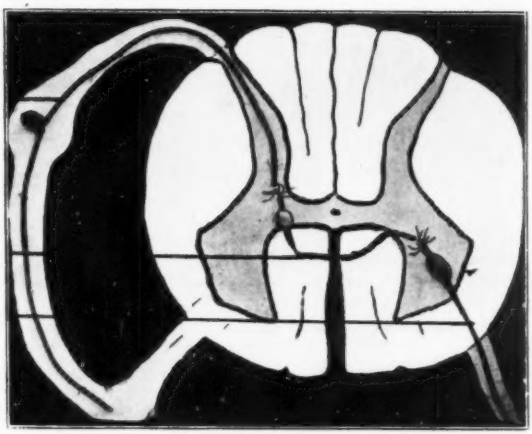


FIG. 1. The neuronic arc with single internuncial element. 'Path' conduction.

between the receipt of the stimulus and the immediate effector response, so that the reflex arc has an immediate summation in motion. In most of the lower animals the nervous system is almost entirely composed of such instantaneous reflex activities, as responses to the appropriate stimuli. In the higher animals such immediate response would often be disadvantageous to the animal's welfare and it becomes, therefore, essential to the well-being of both mammals and man to have a period of latency between the receipt of the stimulus and the motor reaction. This pause in the reflex action, this *period of latency*, furnishes an interval, as it were, for reflection and allows of a selection of the most advantageous motor reaction. This delay in the ultimate effector response to the stimuli will be effected most thoroughly by the substitution, in the nerve arcs concerned, of a large number of connectant or internuncial neurons and synapses between the receptor and effector limbs, in place of the single connectant neuron of the knee-jerk. If,

therefore (fig. 2) the single connectant neuron be removed and there be theoretically substituted a large number of minute, but perfect, neurons (those known technically as Golgi type II or ' granulous ' neurons), it will at once be observed that nerve-impulses from the receptor to the effector sides of the arc have now to traverse an infinite number of minute neurons—in the human brain running possibly into thousands or even millions—and hence a period of latency is induced and the effector response is delayed or even altogether inhibited and suppressed. This important faculty of delaying the effector responses to the incoming stimuli has attained its highest development in the brain of the normal man, and is, indeed, the essence of mind. Behaviour is thus no longer, as in the lower animals, a matter of instantaneous response to the stimuli, but is subjected to a certain degree of

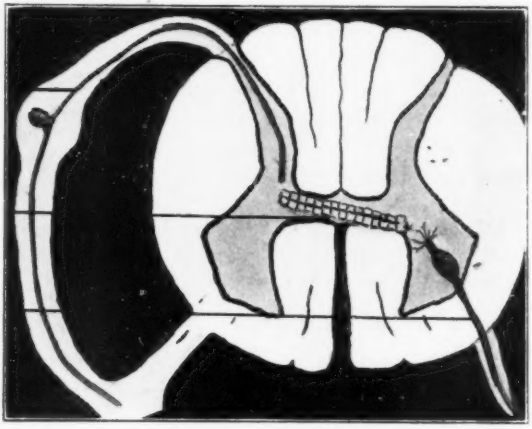


FIG. 2. Theoretically constructed neuronic arc with numerous granular internuncial neurons. 'Ripple' conduction.

supervisional review consequent on the degree of the period of latency and the power of delay or even inhibition. Is there then any portion of the nervous system of man where it can be shown that the connectant neurons between the receptor and effector limbs of the arcs concerned are entirely composed of the Golgi type II variety, instead of the long-axoned single kind just demonstrated in the spinal cord knee-jerk reflex arc? The answer is in the affirmative, for the cerebellum is so constructed.

A COMPLEX SUPRASEGMENTAL MULTINEURONED NERVE ARC (fig. 3).

It is well known that the bodies of all vertebrate animals are built up of a series of segments, and so we speak of the 31 segments of the spinal cord of man. Such portions of the nervous system are, therefore, segmental in

origin, and the type of nervous system concerned is the neuronic reflex arc illustrated in fig. 1. But at the cephalic or head-end of such higher animals there is added a series of nerve structures which are not segmental in origin, and are therefore termed suprasegmental. The cerebellum is such a suprasegmental addition, and its type of neuronic construction differs entirely from that of the segmental spinal cord (fig. 3).

It may be well to recall that the cerebellum is described histologically as consisting from without inwards of three well-defined structural layers—molecular, middle, and internal. The external and internal layers are both composed of minute granular cells of the Golgi type II variety. These cells have somewhat unfortunately received in the past special names and are

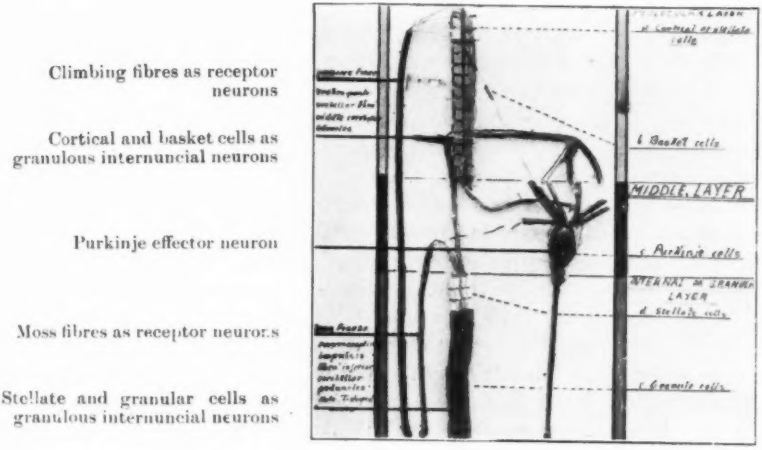

Climbing fibres as receptor neurons
Cortical and basket cells as granulous internuncial neurons
Purkinje effector neuron
Moss fibres as receptor neurons
Stellate and granular cells as granulous internuncial neurons
MIDDLE LAYER
INTERNAL OR GRANULAR LAYER

Fig. 3. The supragranular neuronic arc as found in the cerebellum, with very numerous internuncial neurons of granular type.

known as cortical, stellate, basket, and granular cells, whereas actually and physiologically they are all granular in type. These two layers of the cerebellar cortex are sharply demarcated one from the other by the very distinctive layer of the cell-bodies of the Purkinje cells, which form the middle layer. Running more or less at right angles to the grey cerebellar cortex are certain medullated axons which have received the fanciful names of ' climbing ' and ' moss ' fibres, and commingled with these are the axons of the outgoing effector Purkinje cells.

Moss-fibres are the axons of receptor neurons conveying proprioceptive impulses from the locomotor system through the inferior cerebellar peduncles to the cerebellum. These impulses, on reaching the cerebellum, pass through

the innumerable granular cells, and finally discharge on to the Purkinje cells, which thus represent the outgoing effector neurons of any ordinary neuronic arc. In fact, the Purkinje cells are the only effector neurons which the cerebellum possesses. Expressed still more simply, receptor neurons are represented by the so-called climbing and moss fibres; the internuncial or interposed junctional nerve tissue by the many basket, stellate, and granule cells; and the outgoing effector limbs of the cerebellar arcs by the Purkinje cells.

If this construction be now compared with the simple spinal cord reflex nerve arc represented in fig. 1, it is clear that the only difference in the suprasegmental cerebellum is that the single internuncial long-axoned cell of the knee-jerk arc is replaced by the very large numbers of minute granular cells of the Golgi type II variety. Hence the passage of nerve impulses through such arcs must be considerably slowed down or even arrested.

When we come to study the structure of the brain itself we are generally confronted with a series of obsolete histological diagrams which fail to convince us of the structural relations between nerve-cells and mind. Yet this relationship exists and can be shown to exist, provided the question of cerebral structure be approached from a different angle. To understand brain structure and its relation to mind it is necessary to remember particularly the differences in the junctional nerve tissues of the neuronic arcs of the spinal cord and the cerebellum, for the human brain reproduces both types (figs. 1 and 2), but multiplies enormously the numbers of nerve-cells concerned.

As is well known, there pass to the brain certain well-defined ' sensory or afferent ' tracts, and from it other equally well-defined ' motor or efferent ' tracts. Amongst the former may be mentioned the exteroceptive tracts of vision and hearing, forming the retinal fibres of the optic radiation, and the central path of the cochlear nerve of hearing. Of the purely ' efferent ' tracts the most generally well-known are the ' motor ' pyramidals, lesions of which offer such obvious signs. These and all similar inflowing or outflowing pathways to and from the brain are obviously the equivalents of the receptor and effector limbs of the neuronic arcs of the spinal cord and may, for the moment, be so collectively termed. But what of the cerebral tissue in between? What of the connectant neurons which, just as in the spinal cord reflex arc of the knee-jerk (fig. 1) are, and must be, interpolated between the receptor and effector limbs to complete the necessary neuronic arcs of the brain? As a matter of fact these all are fully described in any good textbook of anatomy or physiology, but their significance as essential elements in the elementary structures of primitive behaviour is usually omitted. Some at least of the cerebral internuncial neurons of the principal receptor and effector channels of the brain are known and described as the short and long association fibres of the cerebral

cortex (fig. 4), and are, in the human brain, like those found in the spinal cord and serve the same purpose. They form quick-acting reflex arcs for immediate responses to the stimuli (fig. 5). The segmented type of reflex

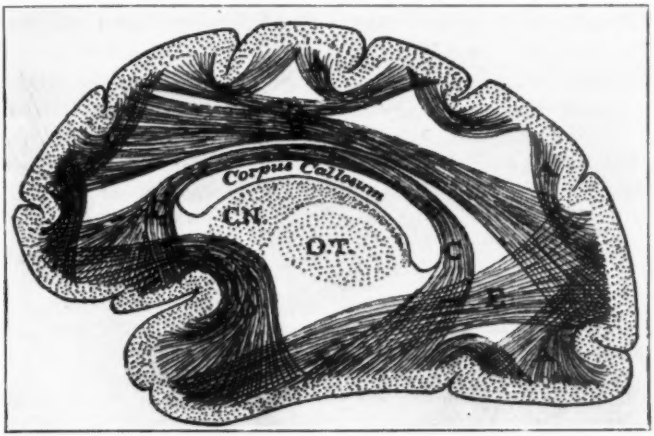
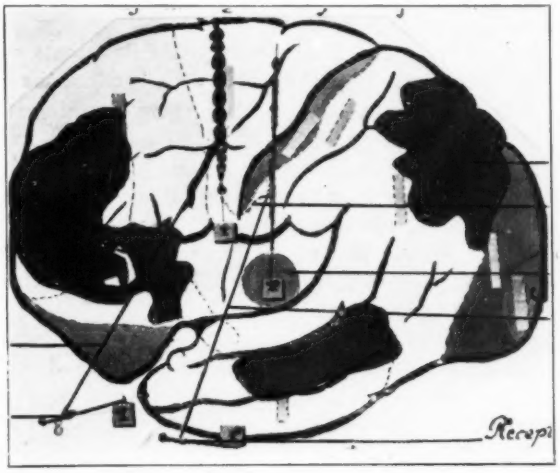


FIG. 4. Some of the chief association tracts of the brain. These are the cerebral equivalents of the fasciculi proprii of the spinal cord, and therefore of the internuncial neurons of the segmented form of the neuronic arc.



Non-functional association area

Internuncial association tract

Auditosensory area

Motor nerve to larynx as effector limb of arc

Cochlear nerve as receptor limb of neuronic arc

Effector organ of speech

Receptor organ of hearing (Corti)

FIG. 5. Model of brain showing spinal cord 'path' type of conduction in an infant's brain during the stage of echolalia. Many imbeciles retain this primitive type of cortical mechanism throughout life.

neuronic arcs is thus retained and elaborated in the human brain, and the elaboration is rendered necessary by the multifarious reactions to which the brain has to give effect. It is unnecessary, once the significance of the association systems in the human cerebral cortex has been realized, to bother with their anatomical names. What they essentially are is what matters, and clearly they are internuncial neurons interposed between receptor and effector limbs of nerve arcs so completing the functional arcs concerned, in much the same way as so many of the axons of the fasciculi proprii of the spinal cord form the connectant links between receptor and effector neurons of simple spinal cord reflex arcs.

> 'The association fibres link together different portions of the same hemisphere, many uniting adjacent areas whilst others connect parts widely separated. They are grouped, therefore, as long and short association bundles. With the exception of a narrow zone in the immediate vicinity of the upper end of the central sulcus the cerebral cortex at birth is unprovided with association fibres which have acquired their myelin sheath. Within the early months after birth, however, the myelinization of these, as well as other tracts, progresses rapidly, although this process is not even moderately completed until after the lapse of several years. Indeed, there is sufficient evidence to believe that myelinization of additional fibres continues so long as intellectual effort is progressive, the demands made by education and special mental exercise being met by a corresponding completion of additional association fibres.' (Piersol, *Textbook of Anatomy*.)

By this arrangement of a retention of the quick-acting spinal cord neuronic reflex arcs, with association internuncial neurons as the connecting links, the brain is enabled to give, where necessary, rapid responses to its many and varied incoming receptor stimuli.

But the human brain also incorporates within its minute structure the suprasegmental or cerebellar type of neuronic arcs, in which the interposition of extraordinarily numerous granulous cells between incoming receptors and outgoing effectors so delays, arrests, or inhibits the reactions to the stimuli, as to afford the physical basis of memory, mind, and language. That man differs so profoundly from even the nearest anthropoid ape is due to the fact that in him the numbers of these granulous cerebral cells and association systems considerably exceed that of any animal, and hence there is ample provision for the physical retention of stimuli in the form of nerve energy which may give rise to memory and speech.

The principles of the suprasegmental type of neuronic arcs, as seen in the human brain, are perhaps easily illustrated from an area of cortex to which much research has been devoted, namely, the visuosensory, situated in the occipital lobes.

THE VISUOSENSORY CEREBRAL CORTEX (fig. 8).

The visuosensory occipital cortex is a typical receptive area of the brain, for on to it are discharged the nerve impulses aroused by the stimulant

action of light waves on the retina. It is now known that all typically receptive areas of the cerebral cortex conform to the suprasegmental type of structure. There is an incoming band of medullated axons conveying receptor stimuli, discharging on to numerous granulous cells. For these reasons the visuosensory cortex is termed by von Economo a heterotypical granulous area.

The advantage of such a model (fig. 8) is that it clearly permits us to see with the naked eye the minute structural details of the brain itself. Thus, light waves falling upon the retina stimulate the rods and cones or receptor organs of the optic nerve. The axons of these nerves pass centrally, as the fibres of the optic radiations, through the brain substance to the visual cortex. In the model they can be seen passing upwards through the white matter into the grey cortex, there forming part of a radial bundle. In the middle of that cortex they turn at right angles to the brain surface, forming a well-marked white band variously known as the stria of Gennari or the outer line of Baillarger, and discharging their impulses on to the innumerable granular cells of Watson's granular cortex. A similar smaller band of medullated axons is also shown discharging on to the polymorphic cells of the infragranuar cortex. As both the polymorphic cells and the small pyramidal cells of this visuosensory area are exceedingly minute, von Economo now regards the small pyramidal cells as granulous or receptive in type. The cells of this visuosensory area seem, therefore, to be comparable with those of the cerebellum and may be regarded, structurally, as forming internuncial or connectant cells between the incoming receptor axons of the optic radiation, and those of outgoing effector or associational neurons.

Of the intensely receptive nature of the visuosensory cortex, Ariëns Kappers says:—

> 'The granular layer is strongly developed in those regions of the neocortex that have an exquisite sensory function—the postcentral or sensory region the frontal cortex, the auditory and visual cortex. In the area striata (visual cortex) afferent (receptor) fibres running in the stria Gennarii and Vicq d'Azyr, end chiefly in the granular layer. This does not mean that the granular layer is the only layer which receives afferent (receptor) impulses. Afferent (receptor) impulses, among which are those transmitted by the corpus callosum, also reach the supragranular pyramids.'

von Economo says:—

> 'The granulous cortex corresponds to the sensory sphere of the cortex in respect of localisation; so that we may consider it to be the sensory cortex par excellence.'

But the problem arises, what exactly takes place in the granular cells in response to the receptor stimuli conveyed to them? That either the cells or their numerous synapses may delay, arrest, or inhibit the passage of nerve impulses through the neuronic arcs in which they occur appears to be certain,

but do the cells themselves play any other part in the phenomena of mind? Elliot Smith, quoted by Herrick, says:—

> 'The ability to learn by experience necessarily implies the development, somewhere in the brain, of a something which can act not only as a receptive organ for impressions of the senses and a means for securing that their influence will find expression in modifying behaviour, *but also serve in a sense as a recording apparatus for storing such impressions*, so that they may be revived in memory at some further time in association with other impressions received simultaneously, the state of consciousness they evoked, and the response they called forth.'

Howell, in the eleventh edition of his *Textbook of Physiology*, says:—

> 'The greater mental activity in the higher animals is dependent, in part, upon the richer interconnection of the nerve cells. . . . A visual or auditory stimulus that in the frog, for instance, may call forth a comparatively simple motor response, may in man, *on account of the numerous associations with the memory records of past experiences*, lead to psychical and motor responses of a much more intricate and indirect character.'

Herrick, in *Brains of Rats and Men*, says:—

> 'In the associational fields we have the machinery for registering in static form the structural modifications (engrams) left by the activation of every cortical associational pathway. *Every such associational pattern which has once been activated seems to be preserved, set as on a trigger, ready to be activated when some related or congruous system of subcortical activities again overflows into the cortical projection centres—the conventional theory of cortical memory* . . . . Many of the neurons involved in one memory may also be involved in a dozen other memories, but linked in different patterns . . . . In the associational zones there is sensual fusion, not only of present complexes of stimuli, but also of vestiges of previous similar activities which have been fabricated through facilitation of path and the retention of these acquired structural alterations—cortical memories, conscious and unconscious.'

Whilst the foregoing extracts, indicative of anatomical, physiological and neurological thought, are not solely referable to the granular cells of the visuosensory area but include many other similar cortical neurons and associational systems, they suggest that all three authorities quoted seem to be in agreement as to the functional properties of the brain-cells concerned, and regard them as doing something more than merely 'delaying, arresting or inhibiting the passage of nerve impulses through them.' 'The storing of such impressions' . . . 'Memory records of past experiences' . . . 'Neurons involved in our memory involved in a dozen other memories'—whatever the language, the ultimate underlying thought appears to be the same—that these brain-cells are, in some way, the physical basis of memory, thought and language, and therefore of those phenomena we term the mind. As Herrick expresses it,

> 'The influence upon present conduct of memories of particular past experience—this does seem to be in mankind a typically cortical sort of nervous action.'

For the further uses of this paper it will then be assumed, either rightly or wrongly, that

'Every mnemonic vestige, every engram, is represented by a complex web of interrelated neurons, each with a potential energy while in the resting condition, and when reactivated in recall (say by sensory or receptive stimuli) the reserve energy of this mnemonic complex is released and is available both to co-operate with the reactivating excitation in determining the nature of the response and also to intensify that response and inhibit or neutralise all other responses . . . . The cortex contains innumerable nervous elements with short axons (Golgi type II neurons) which seem structurally not well adapted to participate in the more extensive associational patterns of the usual memory vestiges, but are so situated as to be able to function in a non-specific way by discharging their reserve energy locally into any associational system that at the moment may be activated within their field . . . Type II neurons give to the human cerebral cortex its unique position as the master tissue of the body' (Herrick, *Brains of Rats and Men*).

The human brain thus combines within itself the segmental spinal cord machinery for quick localized reaction to incoming stimuli, as also a most efficient mechanism for the retention of potential energy, as transformed by neuronic reaction from physical stimuli until the opportune moment arrives for its discharge in the form of action, reaction, or speech indicative of ideas, which up to date in the evolutionary world are the highest form of mind, human or animal, known to us.

THE BRAIN AS THE ORGAN OF MIND (fig. 8).

It will be seen from fig. 8 that there are three chief receptive cortical areas—auditosensory, visuosensory, and somæstheticosensory—about equidistant from each other and all characterized, structurally, by the presence of exceedingly numerous minute granulous neurons. From birth onwards the cortical cells of these areas are constantly influenced by the effects of stimulation, conveyed to them by their own receptor nerves. Thus, the organ of Corti—that is, the receptor organ of hearing—is perpetually responding to sound waves, and so causes the receptor neurons of the cochlear nerve to undergo certain changes which apparently transmute sound waves into nerve impulses. Under this form they are transferred to the granulous cortical neurons of the auditosensory area which, as the result of the stimuli, becomes, as it were, converted into fully-charged live batteries—that is, charged with potential nerve energy, whereas if they do not become so charged, they remain in their neuroblastic, embryological and functionally useless state. The influence of stimuli in the production and phenomena of mind is thus very considerable. Precisely similar and synchronous changes also occur in the somæstheticosensory and visuosensory areas, as a result of which many millions of granulous neurons in the areas concerned become charged with potential nerve energy.

'All living substance in the resting condition has some unexpended potential energy. In the nervous system there is much accumulation of this sort, laid down in a characteristic iron-containing nucleoproteid which is chemically unstable, the chromophilic substance, or Nissl bodies . . . . The known

structure of the cortex indicates that ample reserves (of this energy) are available on demand for reinforcement of any cortical pattern of associational activity whatever.' (Herrick, *Brains of Rats and Men*).

From the primary receptive granulous cortical areas this charging of neurons with potential energy spreads to, and involves, those immediately adjacent portions of cortex known as the auditopsychic, visuopsychic, and somæstheticopsychic areas. Pari passu the short and long associational axons become myelinated and taken up into the ever widening network of functioning and activating cerebral neurons. A slow continuation of the same processes gradually involves that portion of cortex known as the parietal associational area, in which eventually become fused, synthetised and correlated, all those forms of potential nerve energy resulting from a stimulation of the three primary receptive areas by light, sound, and general sensibility.

It will be observed that this process of gradual infection of successive groups of cortical brain-cells with the potential energy resulting from a constant stimulation does not in the least resemble that so generally believed, and which, as the ' path theory of cortical function,' Ashby has adversely and justly criticized. It is much better expressed in his own slightly modified simile of a cerebral pond in which many millions of successive ripples (successively charged neurons) are produced by a constant throwing in of stones (stimuli) at three independent points. Eventually these ripples fuse, coalesce, and weave themselves, within the parietal associational centre of the pond, into those innumerable kaleidoscopic neuronic patterns or engrams essential to the production of mental phenomena. The path theory of cortical function is not applicable, as Ashby points out, to *all* cerebral manifestations. What, however, may possibly have been overlooked is that the path theory *is* applicable to the associational tracts of the cerebral hemispheres, but not to the suprasegmental types of junctional cerebral nerve tissues just considered.

From what has just been stated it should be clear that at birth, and for some time after, there are relatively large areas of cerebral cortex (figs. 6 and 7) completely devoid of all function, for the simple reason that the majority of their cellular elements remain in the embryological neuroblastic non-functional state. These areas have been specially studied by Flechsig who, from his observations on the periods of time at which the axons assume their myelin sheaths, has been enabled to deduce with considerable accuracy the times at which these originally non-functional cortical areas become functional, or differently expressed, the dates at which cortical neuroblasts, especially those of association areas, become converted into fully functioning neurons. That they do become so converted under the influence of incoming exteroceptive and other stimuli seems beyond doubt, as does also the fact that if the conversion does not take place, as, for example, in the visuosensory

area of the congenitally blind, there is a corresponding diminution of the general intellectual level of the individual. The successive stages of the gradual diminution in the sizes of these non-functional cortical areas and

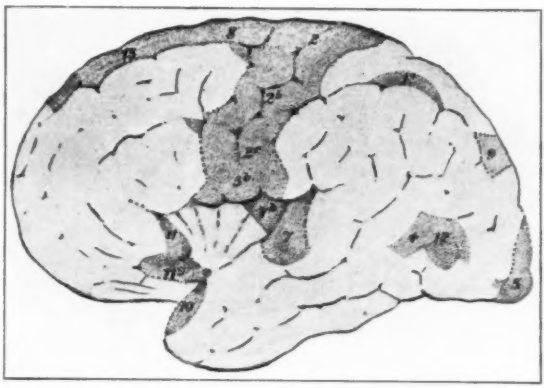


FIG. 6. Flechsig's primordial areas, in dotted zones.

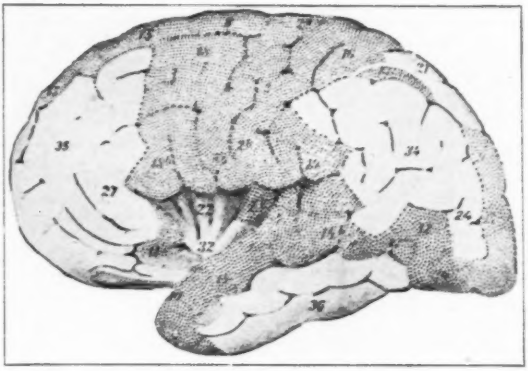


FIG. 7. Flechsig's primordial and marginal areas in dotted zones. In both figures the non-myelinated, and therefore non-functional, portions of cortex are undifferentiated. In fig. 5 these non-functional cortical areas are diagrammatically shown in black. With normal development these areas should complete their myelination, but in the feebleminded they may not do so.

their adoption into physiologically active mind-producing matter is well shown in the figures just referred to.

It is not, unfortunately, possible within the limits of the present demonstration to follow up the weaving of these innumerable cortical neurons (fig. 8) now charged with potential nerve energy into those manifold neuronic patterns and engrams which still further explain, in their countless permutations and combinations, the production of mind from brain-cells.

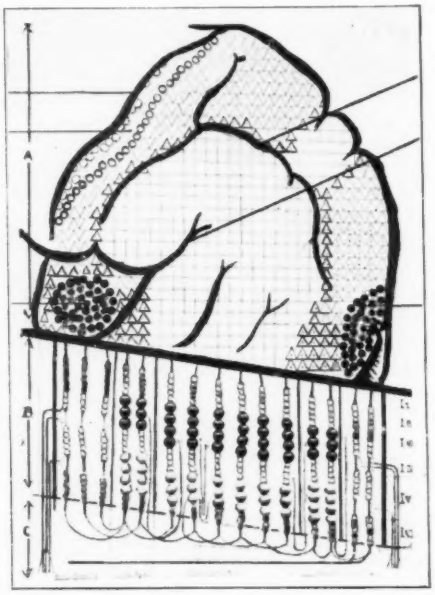


FIG. 8. Occipital half of left cerebral hemisphere seen in two dimensions.

Upper part. Cortical surface. Primary receptor zones in circles; secondary receptor zones in triangles; association area in squares.

Lower part. Section through the cortex showing the construction, as modelled in beads, of the areas concerned. After von Economo's microscopic studies.

From left to right.

Auditosensory (somæstheticosensory) area.				Economo:	Type	5	cortex
Auditopsychic area	...	..	...	,,	,,	4	,,
Association area	...	...	...	,,	,,	3	,,
Visuopsychic area	...	...	...	,,	,,	4	,,
Visuosensory area	...	...	..	,,	,,	5	,,

It may, however, be pointed out that this discussion has only concerned itself with the *building up* of the cerebral structure of mind. Once these myriads of brain-cells have been converted, under stimulation, into energy-holding and -producing agencies, they may change that potential energy into kinetic energy, and may do so under any stimulus whatsoever,

whether arising from within or without the body. Once built up they obviously do not require rebuilding—in fact, a self-regulating mechanism has been set up—for from the one exposed negative many pictures may be obtained, and the human brain contains still more ' unexposed negatives ' in the form of neuroblasts awaiting the necessary stimuli to convert them into activating and functional neurons.

CLINICAL APPLICATIONS.

Passing next to some clinical applications of the facts already recounted of the relationships between brain-cells and mind, there may be instanced the actual physical and neurological phenomena now taking place. Sound waves induced by the lecturer's voice, and light waves reflected from the pictures on the screen are impinging on the corresponding receptor (sense) organs of the audience—that is, upon the organ of Corti and the rods and cones of the retina. These stimuli, transformed into nerve energy by the neurons of the cochlear and optic nerves, impinge on the myriads of cortical cells of the auditosensory and visuosensory areas of the cerebral cortex, inducing in them some as yet little-understood chromatolytic changes which result in an accumulation of potential energy. These changes spread, like ripples on water, to many other cerebral cells, especially those of the association areas, which thus accumulate and retain, in potential form, the nerve energy generated in response to the stimuli. It is obvious that, as yet, this potential energy has not given rise to any effector or other response on the part of the audience, which has, indeed, remained passive throughout. But the potential nerve energy which has so become accumulated in the brains of one's hearers will not remain potential for ever. Sooner or later some other stimulus will come along and cause the potentially charged neurons of to-night to liberate energy in kinetic form, and effector responses will be manifested in the form of speech, discussion, and exchange of ideas relative to the events of the lecture.

But contrast this delayed reaction to the stimuli with the extremely rapid locomotor ones which this audience would instantaneously display were the lecturer suddenly and unexpectedly to produce a couple of automatic quick-firing guns and loose them off in accordance with the best practice of the racketeers of the North American continent. No longer would the audience fail to respond to the incoming stimuli of sight and sound, but would react both rapidly and effectively. Clearly then the human brain can adapt itself to two totally different series of requirements. It can absorb stimuli in the form of potential nerve energy until such time as it is most advantageous to utilize it, or the potential energy can be immediately and instantaneously converted into kinetic form, with appropriate locomotor or other effector responses to the stimuli. And this, it will be remembered, is

strictly in accordance with those structural details of brain construction, the outlines of which have already been set forth. For instantaneous responses to stimuli of sound, sight, or touch, the human brain utilizes the numerous spinal-cord types of neuronic arcs with which it is provided, the elements of which are the receptor nerves, the long association fibres, and the appropriate effector pathways (fig. 5).

For delayed reactions to the stimuli, the mechanism employed is the numerous small pyramidal, granular and polymorphic cells among which the production of potential energy delays, arrests, or even entirely inhibits the effector responses to the incoming stimuli (fig. 8). The *first* is the spinal-cord or segmented type of neuronic arc with ' path ' mode of function, designed to give rapid and instantaneous reaction to the stimuli. The *second* is the suprasegmental or ' ripple ' type of neuronic arc conduction, with extraordinarily numerous interpolated internuncial neurons between the receptor and effector limbs of the arcs, which delay, arrest or may even totally inhibit the reactions to the stimuli.

Although it is clear that there are two distinct types of mechanism in the completely developed brain, namely, the spinal-cord type for quick reaction, and the suprasegmental type for delayed response, it is apparent that in the fundamental whole these two types must co-operate in an intimate way. The reaction to the revolver episode can only occur when the sense of danger, i.e., the meaning of the total situation is first realized by the audience. It would appear, then, that even though the primitive effector (spinal type) response is used, it is not, in the fully developed brain, an isolated, purely reflex phenomenon, but is appropriately employed by a cerebrum acting as a whole. What can be conceived of as a primitive structure has, in fact, become incorporated into the fully developed nervous system.

SPEECH.

Of other practical applications of some of the foregoing facts of cerebral construction and the logical deductions therefrom, attention may be directed to their important bearing on the clinical significance of the acquisition of speech. Unfortunately, medical attention is mostly devoted to its loss, as in the aphasias, rather than to its acquisition, and yet in the mental phenomena associated with that lack of cerebral development termed mental deficiency it is not the loss of speech, but the failure to acquire it which is of such profound clinical significance.

During the first twelve months after birth the normal child is little more than a speechless automaton, yet during this period important changes occur in the brain, which prepare the way for all future mental development. Amongst these changes are those of conversion of functionless neuroblasts

into functioning neurons and the acquisition by them of myelin sheaths. At about the fourteenth month of normal development the child commences to utter meaningless words, which are nothing more than repetitions of the last sounds of syllables heard. This stage of *echolalia* (fig. 5) is thus described by Wyllie in his classical but seldom read work, *The Disorders of Speech:*—

> 'It is in the cortical centre for hearing that the sound is first registered. By-and-by the motor area becomes trained or developed to reproduce the word heard. Thus the child reproduces many words that he hears, in parrot-like fashion, by echolalia, without making any attempt to understand them.'

Now it requires no very profound knowledge of the intricacies of the nervous system to understand the nerve mechanism involved in echolalia. The cochlear nerve of hearing represents the receptor limb of the arc, with the organ of Corti as the receptor or sense organ. The auditosensory area, with its innumerable minute receptive cortical neurons, is the chief cortical receptive centre. The polymorphic and other cells whose axons form the short association fibres passing from the auditosensory area to that part of the Rolandic motor area concerned with the muscles of the lips and larynx represent the internuncial neurons of the arc, whilst the neurons proceeding to the appropriate muscles form the effector limbs of the arcs, and so complete the nerve circuit. In echolalia the brain is obviously utilizing the simple segmented spinal-cord type of arc with ' path ' conduction and immediate response, just as it did in the revolver episode previously mentioned, or as the spinal cord itself does in the knee-jerk.

But pari passu with this, a much more intricate process is going on in the developing brain of the normal child (fig. 8). Exteroceptive stimuli of sound, sight and touch are being constantly poured into the cerebral cortex, as a result of which the auditosensory, visuosensory, and somæstheticosensory areas are activated to the conversion of immature brain-cells into mature ones and the production of more and more potential nerve energy. This dual process is passed on, in the ' ripple ' form of cerebral conduction, to the auditopsychic, visuopsychic, and somæstheticopsychic areas, and finally to the appropriate association area, in this case the parietal, where the various sense stimuli appear to be fused and retained in the form of potential nerve energy. This process affects many thousands, or more likely millions, of cerebral cells and processes, which later, and under suitable stimulus, liberate their potential nerve energy in the kinetic form, and so the child becomes transformed from a senseless automaton into a sentient, intelligent, human being.

The nerve mechanism here employed is entirely different from the reflex arc type which is the basis of echolalia, for it involves the many myriads of interposed suprasegmental internuncial cells with which the human brain abounds. The conversion of the numerous neuroblasts of these supra-

segmental cerebral arcs into functioning neurons, and the necessary myelination and connexions of their associational and commissural axons naturally take time and cover, or should cover, the first 18 or 20 years of life. Speaking generally, the earlier it ceases, the greater the mental deficiency, and the later it ceases the higher the intelligence.

But suppose these twin cerebral processes do not occur? Suppose that from any cause whatever the cerebral neurons remain developmentally imperfect and that neither the spinal-cord echolalia ' path ' conduction arcs, nor the suprasegmental ' ripple ' ones attain maturity? What happens? The child grows up as a physical and possibly a sexual adult, but mentally is, and must be, an idiot, devoid of speech and intelligence. Given accurate observation, by any intelligent general practitioner, of such a developing child during the years of infancy and childhood, a prognosis of future idiocy can be made with certainty from a study of its speech reactions alone. Cerebral cortical histology thus leads to a most important clinical dictum, which is, that unduly late acquisition of speech by a child is a certain indication of a future state of amentia. If, during the first five years of life, there is no attempt at speech, or no utterance of sounds other than the grunts and animal noises of early infancy, idiocy can be prognosticated with some certainty. A diagnosis of future imbecility can similarly be made if the child be found to remain permanently in a state of echolalia (fig. 5). But there is something more involved even than this purely clinical observation, important though that is. If what has been stated as to the two modes of cerebral conduction—' path ' and ' ripple '—has been followed, it is clear that this failure to acquire adequate speech has given still more valuable information, for it affords the expert an adequate conception of the actual state of development and faulty neuronic construction of the brain itself, and thus establishes an accurate basis upon which to found one's psychological and other medical studies of the patient.

FEEBLEMINDEDNESS.

Passing next to the higher grades of mental defectives—the feebleminded—it is certain that in them the brain attains a much greater degree of development, with a mentality about equal to that of a normal child of from 7 to 10 years and a Binet I.Q. of from 50 to 70, the limits and range being subject to much individual variation. Here it is impossible to state, neurologically, exactly which part of the brain is lagging behind in its development, but it is almost certainly some part of the association areas, and specially concerns the pyramidal-celled or supragranular cortex (figs. 7 and 8). It has already been shown that, at birth, the association areas are not functional because, as Flechsig has proved, the axons are not myelinated. Under the influence of normal environmental stimulation from exteroceptive sources the cells of these areas become fully developed, their axons

myelinated, and they become taken up into the evergrowing network of neuronic arcs, patterns and engrams, until eventually all parts of these association areas are functioning, and normal mentality is attained. In feeblemindedness this process of absorption of non-functional cortical areas into fully functioning brain matter becomes prematurely arrested, and the degree of feeblemindedness presented depends entirely at what stage this process ceases. There are, of course, many clinical, psychological, intelligence, and other tests for determination of the grade or degree of feeblemindedness, but from the neurophysiological standpoint a study of the patient's language and vocabulary is as illuminating and interesting as any. As regards the former it is, as a general rule, the consonants which present more difficulties to the feebleminded than the vowels, and they frequently retain, in their language, some at least of its more infantile features. Amongst these may be mentioned ' smudging ' or scamping of the syllables, as in baby speech, slurring and lalling, whilst some form of stammering is not uncommon. Speaking generally, disorders of speech and a retention of infantile features common to its acquisition are sign manuals of an underdeveloped cerebral cortex of greater or less degree.

Cortical studies of structure also seem to throw further light on epilepsy, fits, convulsions, and other similar manifestations of discharge of nerve impulse in an aberrant kinetic form. The cortical explanation would appear to be that either owing to an insufficiency of intracortical internuncial neurons between the receptor and effector limbs of the cortical arcs, or an excess of short associational junctional tissue, or both, nerve energy—the result of a summation of minute stimuli—is transmitted too directly to effector cells, thus causing in the latter a massive discharge of kinetic nerve energy, that is, a greater number of motor or effector cells are brought into prolonged activity. Whether this be or be not the explanation it supports the view that epilepsy is not a disease but a symptom of an imperfectly developed nervous system. Certainly the lower grades of mental defectives, in whom the nervous system is most imperfect, are those in whom epilepsy most frequently occurs. Consequently the legendary statements concerning some of the world's military and other geniuses popularly believed, on insufficient evidence, to have suffered from epilepsy, should be received with suspicion. As Wilson remarks:—

> ' There are many organic nervous states of which epileptic fits are a symptom; in fact, the epileptic fit is nothing else than a symptom. No such disease as epilepsy exists, or can exist.'

And modern cortical structural studies support this view.

It has been stated that feeblemindedness appears to be due to a lack of development of the association areas, and specially concerns the pyramidal or supragranular cortex. Thanks to the work of G. A. Watson, Shaw Bolton, Mott, and others, it is known today that only the mammals have a true

neopallial cerebral cortex, and that in them this cortex is laid down on an infragranular basis (fig. 8). In the higher mammals, and especially in the anthropoids and man, the three-layered cerebral cortex of the marsupials becomes a five-layered one by the addition of layers of pyramidal cells. Hence it is not improbable that the human cerebral cortex functions in horizontal strata in addition to the localized 'centres' previously recognized. Howell, in the last edition of his well-known *Textbook of Physiology*, says:—

> 'It is pointed out that if we omit the outer or molecular layer the other cells of the cortex fall into three groups, namely, the granular layer, the supragranular layer—comprising the pyramidal cells external to the granular layer—and the infragranular layer—comprising the pyramidal and fusiform cells internal to the granular layer. Comparison of the cerebral cortex in the brains of the different vertebrates indicates that the supragranular cells have appeared relatively late in the phylogeny of the vertebrates, and have reached their greatest development in the human brain. The suggestion occurs, therefore, that these cells have a different functional significance from those in the infragranular layer. It has been supposed that the supragranular cells mediate the socalled higher psychical processes, which characterise man and the related mammalia as compared with the lower vertebrates. The infragranular cells, on the other hand, constitute a primitive layer which has obvious connection, through projection fibres, with the underlying parts of the brain and of the body at large. These cells form, therefore, a mechanism through which the brain is connected directly with the rest of the body, and through which the older instinctive reactions are controlled.'

It is difficult for any scientifically trained clinician to study the mentally defective without reaching the conclusion that there is much to be said for the laminar conception of cerebral function. If the supragranular pyramidal cells are deficient in numbers and development there must be a corresponding diminution of the medullated axons of the white matter, and therefore a diminished brain volume and a smaller head. An examination of over 2,000 mentally defective patients in both Australia and England, with accurately recorded head measurements, has convinced me that microcephaly or smallheadedness is almost pathognomonic of feeblemindedness, as I have found it in about 80 per cent. of all cases.

Bolton has shown that in the lower grades of mental defectives we may expect to find a diminution in the thickness of both the infragranular and supragranular cortices with a resultant idiocy or imbecility. In the higher grades this diminution in thickness of cortical matter affects chiefly the supragranular cortex, hence the feebleminded appear to derive whatever mentality or intelligence they may possess from their infragranular cortex, through which, according to Watson and Howell, the older instinctive reactions are controlled. And this, too, certainly reveals itself in the general reactions, instability, paucity of vocabulary, and more animal reactions of the feebleminded. There is thus every reason to believe that cortical histology, carefully checked by clinical and scientific observations, is opening up new ground in the field of mental science.

Lastly, there is the still more recent work of von Economo, Jakob, and others, who have pointed out that in certain aberrant forms of mentality associated with the insanities there can be demonstrated an actual destruction of cortical cells in some of the different laminæ. Even though none of these several observations be regarded as proven, they are, at least, all heading in the same direction, and that is, to brain-cells as the undoubted organs of mind.

Notwithstanding that the practitioner of medicine may, at first, imagine that cortical histology is a repellent subject, devoid of interest to any but the expert, it is to be hoped that this demonstration may have shaken his faith in his pessimism. Today, when all are so anxious to recognize mental disturbance as early as possible with a view to the adoption of more hopeful preventive measures, rather than the more hopeless curative ones, there is given to the general practitioner a great opportunity. To him and to him alone must we look for that careful study of the mental development of the infant and child which is so essential if mental disorder is to be recognized early enough for effective preventive measures, and to him too we look for a realization of the fact that the ' phenomena of the human mind are *not* too complex to admit of their structural explanation or understanding.'

TUMOURS OF THE BRAIN ASSOCIATED WITH MARKED PLEOCYTOSIS IN THE CEREBROSPINAL FLUID.*

By

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A SLIGHT or moderate pleocytosis in the cerebrospinal fluid is not rare in cases of tumour of the brain. Greenfield and Carmichael[1] state that a slight pleocytosis (5-10 cells) frequently occurs in cases of cerebral tumour. Alpers[2] examined the ventricular fluid in 102 cases and found a pleocytosis in nine instances; from 7 to 20 cells in seven fluids, 73 cells in one fluid, and 375 in another. Spurling and Maddox[3] studied the cerebrospinal fluid from 108 patients and reported that the cell count was low, usually under 3. Moersch[4] examined the cerebrospinal fluid obtained by lumbar puncture from 252 cases of cerebral tumours; he found more than 100 cells in two cases only. The finding of a large number of cells in the cerebrospinal fluid is rare, and for this reason we are reporting two such cases that have come under our observation.

PERSONAL CASES.

CASE 1.—E. C. The patient was a white Syrian merchant, aged 62; admitted to the Neurological Service of the Boston City Hospital, February 7, 1929, in a semicomatose condition. The following history was obtained from his daughter.

Until three weeks prior to entry the patient was perfectly well. At this time he developed a headache, just before or after sustaining a slight injury to his head. Ten days before entry he had a chill and was confined to bed for one day. He appeared to be confused, as he was playing with his fingers and had washed his face with an orange. For one week the daughter had noticed that the patient seemed sleepy, talked very slowly, complained of severe pain in both temples, and was incontinent of urine. Six days before entry he vomited, became very drowsy and slept continuously. On the day of admission the patient put his right hand to the right side of his head frequently. There was no record of fever while at home.

Physical examination showed a well developed but poorly nourished elderly male in a deep stupor. The skin was moist and the lips were slightly cyanotic. There was a mucopurulent discharge in the posterior nasopharynx. The ear drums appeared normal. There was moderate opisthotonus, slight stiffness of the neck, and bilateral Kernig's sign. The brachial and radial arteries showed a moderate degree of arteriosclerosis.

The right pupil was larger than the left; both reacted sluggishly to light. There was a mild choking (1-2 diopters) of the optic discs. Otherwise the cranial nerves

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were normal. The patient did not move the left arm or leg except on stimulation, whereas there were frequent spontaneous movements of the right limbs. The deep reflexes and the tonus of the muscles were increased on both sides but slightly more so on the left. There was bilateral ankle clonus which was more sustained on the left side. The left cremasteric reflex was absent. There was a positive Chaddock sign and a questionable Babinski reflex on the left.

The urine was normal. Examination of the blood showed 15,000 white blood cells and 5,500,000 red blood cells per c.mm. The blood Kahn test was negative and blood culture was sterile. The lumbar puncture showed an initial pressure of 450 mm. of water. The fluid was cloudy, xanthochromic and contained 2,106 white cells per c.mm., 90 per cent. of which were polymorphonuclear leucocytes. The total protein content was 216 mgm.; the sugar was 80 mgm. and the chloride content was 696 mgm. per 100 c.c. The Wassermann reaction of the fluid was negative.

These changes in the cerebrospinal fluid were interpreted as indicating that there was a suppurative process within the brain which had not as yet caused a meningitis. The left hemiparesis indicated that the lesion was in the right hemisphere, and from the history of mental disturbance it was thought that the lesion was probably frontal. Therefore, the diagnosis of abscess of the right frontal lobe was made, and the right frontal region was tapped by Dr. Donald Munro on the day of admission. No pus was found and culture of the bloody material obtained on aspiration was sterile. Dr. Munro thought that the brain tissue in the region explored seemed unusually soft.

The following noon lumbar puncture was again performed. The initial pressure was 300, the fluid was cloudy and slightly blood tinged. There was questionable evidence of spinal block. The fluid contained 3,000 white cells which were chiefly polymorphonuclear leucocytes and 45,000 red blood cells per c.mm. The sugar content was 75 mgm., chlorides 705 mgm., and total protein 426 mgm. per 100 c.c.

The patient became more stuporous with rapid respiration and died about twenty-four hours after admission.

TABLE 1.

THE CEREBROSPINAL FLUID FINDINGS IN CASE 1.

Date	Pressure	White blood cells	Total protein mgm./100 c.c.	Sugar mgm. 100 c.c.	Colloidal gold	Comment
2 7 29	450 mm.	2106	216	80	0001110000	—
2 8 29	300 mm.	3000	426	75	0011110000	After operation

Necropsy.—At necropsy a large infiltrating tumour was found in the medial portion of the right frontal lobe (fig. 1) involving the corpus callosum and extending into the left frontal lobe. The anterior horns of both lateral ventricles were compressed by the tumour. The tumour appeared vascular, and there were numerous small hæmorrhagic areas. Microscopic examination showed the tumour to be a glioblastoma multiforme.

CASE 2.—E. B., a 54-year-old white, married, printer, was admitted to the Boston Psychopathic Hospital, October 23, 1931, in a depressed state. The following history was obtained from his brother.

With the exception of typhoid fever in 1900 the patient had always been in good health. For the past two years he had been worrying a great deal and was not feeling well. Eight weeks before admission he began to complain of nervousness and expressed fear that he was going to have a nervous breakdown.

He lost interest in his work and said that both of his legs felt weak. One month before entry he had an attack of muscular rigidity and a momentary loss of consciousness. He was driving his automobile at the time, but he regained possession of his faculties in time to prevent an accident. He continued to have transient attacks of general weakness and fell on several occasions. One week before admission he fell eight feet down the stairs, striking his head but not losing consciousness. Since then he complained of general weakness. He was in a depressed mental state and worried considerably about himself. He was seen in consultation by a local neurologist and was sent to the hospital with the diagnosis of 'hysteria.'

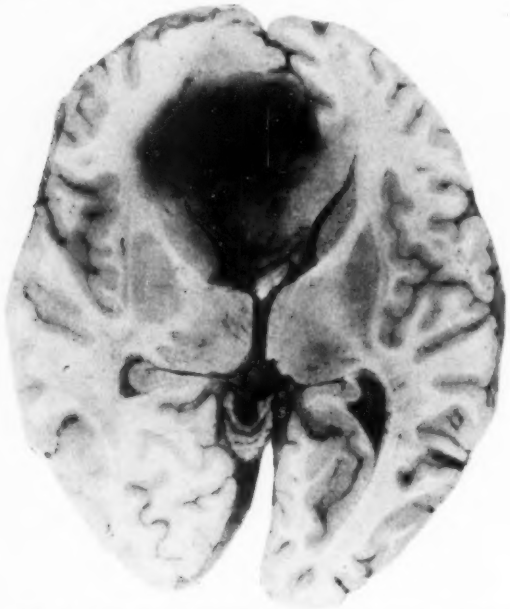

FIG. 1.—Case 1. Horizontal section of brain showing tumour mass in left frontal lobe, which has involved the corpus callosum and spread to the opposite frontal lobe.

Examination.—The general physical examination was negative. The blood pressure was 128/70. There was a marked slowing of all mental processes. He responded very slowly to questions. There was no disturbance of orientation, no delusions or hallucinations. He spoke of feeling depressed and wept easily.

On neurological examination the cranial nerves were normal. The fundi, visual acuity and visual fields were normal. On examination of the motor system the patient cooperated very poorly, but no definite weakness of any muscle groups could be found. The gait was very unsteady, he walked slowly, staggered from side to side, and required help in getting in and out of bed. In the performance of these tests the patient gave the impression that he was able to support himself and walk better than he was doing. No tremors or involuntary movements were noted. He spoke in a whisper, but on encouragement he could speak in a normal

tone. No psychomotor disturbance or apraxia could be demonstrated. A satisfactory sensory examination was not possible, but no gross disturbance was noted. The deep reflexes were all moderately hyperactive. On plantar stimulation there was a doubtful Babinski response on the left while the response on the right was definitely flexor in type.

The urine and blood were normal. The blood Wassermann was negative. X-rays of the skull showed a poorly defined shadow just above the lambdoid suture on both sides which was interpreted as a slight thickening of the inner table of the skull. The sella turcica was normal.

There was little change in the condition of the patient for the first six days of his stay in the hospital. The first lumbar puncture was perfomed three days after admission. Unfortunately no record of the pressure was made at this time. The fluid was clear and colourless and contained 8 white cells (lymphocytes) per c.mm., 82 mgm. of protein and 74 mgm. of sugar per 100 c.c. The colloidal gold curve was 0012300000, and the Wassermann reaction of the fluid was negative.

On the sixth day after entry, the patient sank into a semicomatose condition and could be aroused only for feeding. He was incontinent and his respirations were of the Cheyne-Stokes type. The temperature which had previously been normal rose to 101°. There was no stiffness of the neck or Kernig's sign. Lumbar puncture on October 29 (six days after entry) showed an initial pressure of 250 mm. of fluid with marked variations with the respirations (Cheyne-Stokes), and normal dynamics. The fluid was cloudy and contained 4,000 white cells, 70 per cent. of which were of the polymorphic neutrophilic type. Chemical examination showed 235 mgm. of protein and 43 mgm. of sugar per 100 c.c. Cultures of the blood and cerebrospinal fluid were sterile. In spite of the negative smears, cultures and only slightly reduced cerebrospinal fluid sugar content, the patient was treated with anti-meningococcus serum by the intraspinous and intravenous routes. He remained in a comatose condition for the next five days, during which he received numerous lumbar and cisternal punctures for the administration of serum. The lumbar puncture findings on the various punctures are shown in Table 2.

TABLE 2.

THE CEREBROSPINAL FLUID FINDINGS IN CASE 2.

Date	Source	Pressure	White blood cells	Total protein mgm./100 c.c.	Sugar mgm./100 c.c.	Colloidal gold	Comment
10/26/31	lumbar	—	8	82	74	0012300000	—
10/29/31	lumbar	250mm.	4000	235	43	0000121000	serum given
10/29/31	cistern		4800	145	62	0011232100	,,
10/30/31	lumbar	75mm.	7200	1638	31	2223455555	,,
10/30/31	lumbar	70mm.	600	468	78	3344354433	,,
10/31/31	lumbar	—	200	216	63	2223345555	,,
10/31/31	cistern	—	108	156	66	3344322100	,,
11/1/31	lumbar	—	258	266	61	3445555431	—
11/1/31	cistern	170mm.	80	160	66	3455554311	—

The temperature was constantly elevated, varying from 98° to 103°. The patient died on November 2.

Necropsy.—The necropsy was performed four and one-half hours after death by Dr. Myrtelle Canavan. The abdominal and thoracic viscera showed nothing of significance. Externally the brain was of normal appearance, but when cut in frontal section a large infiltrating tumour was found in the mesial portion of the frontal lobes, involving the corpus callosum and the adjacent white matter of both hemispheres. The tumour extended from the level of the tip of the olfactory bulb anteriorly to the level of posterior portion of the optic chiasm posteriorly. The anterior horns of both lateral ventricles were compressed by the tumour mass.

FIG. 2.—Case 2. Frontal section at the region of the optic chiasm showing area involved by the tumour mass. Note relatively fresh hæmorrhage in the upper portion of the tumour in the right frontal lobe.

The tumour was very vascular in appearance, and in its posterior portion there was a fresh hæmorrhagic area about 2 × 2 cm. in diameter. No definite line between tumour tissue and brain could be found, but the greatest diameters of the tumour were approximately 3 cm. in the anteroposterior direction and 8 cm. in the transverse (fig. 2).

Microscopic sections of the tumour showed that it was composed chiefly of spongioblasts, and the microscopic diagnosis by Dr. Canavan was glioblastoma multiforme (fig. 3).

DISCUSSION.

In the first case the rapid onset of the symptoms and the finding in the cerebrospinal fluid of a marked pleocytosis with normal sugar content led to the diagnosis of cerebral abscess, although no primary focus was evident. The finding of a glioma at autopsy came as a surprise.

The second case was sent to the Boston Psychopathic Hospital by a competent neurologist with the diagnosis of hysteria. The behaviour of the patient in the wards tended to substantiate this diagnosis, but the minor

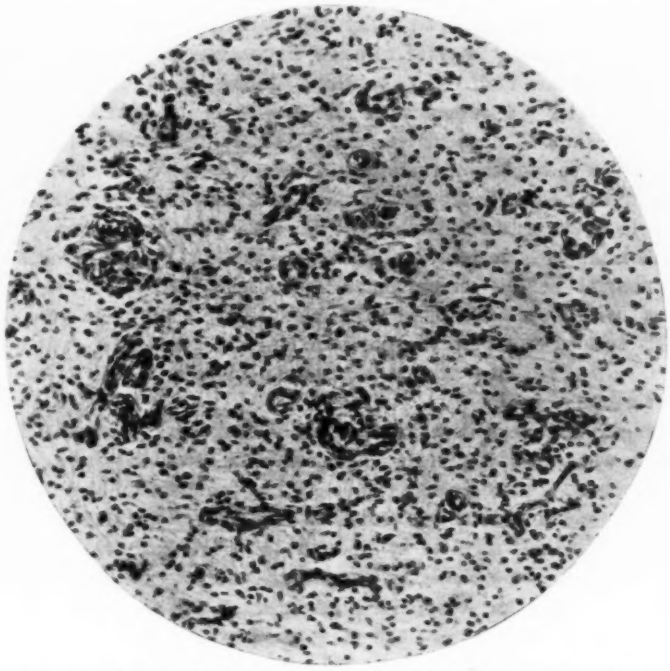

FIG. 3.—Case 2. Section from central portion of tumour showing the marked vascularity and the cellular nature (cresyl violet stain).

abnormalities found on examination pointed to an organic involvement of the central nervous system, as did also the changes in the cerebrospinal fluid found on the first puncture. Unfortunately the operator failed to record the intracranial pressure at the first puncture and a definite diagnosis could not be made. When the patient sank into a coma a few days later, however, a second puncture was performed. At this time the intracranial pressure was slightly elevated and the fluid was purulent. Although the sugar content of

the fluid was only slightly below normal and no organisms were seen on smear, it was thought wise to give the patient anti-meningococcus serum on the chance that he had developed a meningeal infection while in the wards. With further observation it was evident that the patient did not have an infection of his meninges, but that there was an intracerebral lesion, probably an abscess or possibly a tumour. The absence of any definite localizing signs and the extremely poor condition of the patient prevented any operative measures.

The cerebrospinal fluid in the second case was especially interesting in that the pleocytosis developed under observation, and that the patient lived for a sufficiently long interval to allow us to observe the further course of the changes in the fluid. On the first puncture the fluid had only 8 cells. Three days later the patient sank into coma and the fluid contained 4,000 cells. There was subsequent temporary increase in the cell count which can be attributed to the serum therapy. After this there was a steady decrease in the number of cells in the cerebrospinal fluid until there were only 80 white blood cells in the cisternal fluid on the day before death.

The findings of increased intracranial pressure, pleocytosis and normal sugar content in the cerebrospinal fluid usually indicate a septic focus (abscess) within the brain or in close relationship to the meninges. During life this seemed the best diagnosis in both of our cases. The necropsy showed, however, that a central tumour can cause a marked pleocytosis in the cerebrospinal fluid.

Similar cases have been reported by Parker[3] and Moersch[4]. The case of Parker was that of a glioblastoma multiforme of the temporal lobe which had compressed the middle cerebral artery and produced an area of softening in the temporal lobe near the ventricle. The cerebrospinal fluid contained 1,707 cells. In those reported by Moersch[4] the greatest pleocytosis was found in the case of a glioma involving the corpus callosum (anterior portion) and both frontal lobes. He reports three punctures in this case. The cell counts are reported as ' many,' 679 and 90 respectively. In the only other case in his series showing over 100 cells per c.mm. a glioma of the left temporal lobe was found. Only one puncture is reported in this case and the fluid contained 191 white blood cells, 50 per cent. of which were polymorphonuclear leucocytes.

It is interesting to note that our two cases and one of Moersch's involved the anterior portion of the corpus callosum. Ironsides and Guttmacher[6] called attention to the frequency of increased protein and cells in the cerebrospinal fluid as the result of a tumour of the corpus callosum. None of their cases, however, had over 100 cells per c.mm. in the fluid.

The most satisfactory explanation of the occurrence of pleocytosis in the cerebrospinal fluid of cases of cerebral tumour is that it is due to the

release of cells into the ventricles or subarachnoid space from the symptomatic inflammation which occurs around an area of tissue degeneration. This hypothesis is supported by the work of Cone and Barrera[7], in which they produced aseptic cerebral embolism in animals. They found that polymorphonuclear cells were poured out in the region of the infarcted area, and that these cells can reach the cerebrospinal fluid by way of the perivascular spaces, or by direct extension into the fluid when the softened area is in close relationship to the ventricles or the subarachnoid space.

Areas of softening occur in cerebral tumours as result of ischæmia or hæmorrhage, particularly in the rapid growing glioblastoma multiforme, and cells can find their way to the cerebrospinal fluid from the symptomatic inflammation which occurs around such necrotic areas, especially if they are near ventricles. In our second case it is most likely that the large hæmorrhage which was found in the tumour at necropsy was responsible for the onset of the coma and for the cells in the cerebrospinal fluid. In our first case, although the hæmorrhagic areas were smaller, they were probably responsible for the pleocytosis in the cerebrospinal fluid.

A further illustration of the occurrence of a pleocytosis in the cerebrospinal fluid as the result of a focus of necrosis near the ventricles is presented by the following case recently seen at the Boston City Hospital.

A white male (A. B.), 47 years of age, was admitted to the hospital in coma. The patient was known to have had a high blood pressure for several years, and on the day of admission he had had a 'stroke' characterized by a sudden onset of coma and the development of a left hemiplegia. On admission his systolic blood pressure was 200 mm. of mercury and the diastolic pressure was 140 mm. The cerebrospinal fluid was under a pressure of 180 mm. of water. The fluid was slightly turbid and contained 700 cells per c.mm., 42 per cent. of which were polymorphonuclear leucocytes. The protein content of the fluid was 56 mgm. and the sugar content 87 mgm. per 100 c.c. The patient died five days later and at necropsy a large hæmorrhage was found in the region of the right internal capsule and basal ganglia. There was no blood in the ventricles and the hæmorrhage was separated from the ventricles by a thin layer of necrotic brain tissue.

The rarity of cases of brain tumour with marked pleocytosis may be explained in part by the fact that lumbar punctures are usually not performed in cases with high-grade choked discs or when the diagnosis is evident. Even if such cases are punctured, cells would only be expected in those cases where a recent hæmorrhage or area of softening had occurred.

SUMMARY.

Two cases of glioma of the anterior portion of the corpus callosum and frontal lobes which showed a turbid cerebrospinal fluid are reported. The literature on this subject is discussed and the presence of the polymorphonuclear cells in the cerebrospinal fluid of cases of brain tumour is explained as being due to drainage of cells from the area of symptomatic inflammation occurring around foci of necrosis close to the ventricles.

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MENTAL CHANGES ASSOCIATED WITH PERNICIOUS ANÆMIA.

By

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It is well known that pernicious anæmia may manifest itself as a disease of the blood or of the nervous system, or that it may, at first, appear to be a morbid condition purely of the gastrointestinal tract. The occurrence of abnormalities of conduct as a symptom or even as a prodromal sign is, however, less generally recognized, and yet a considerable number of patients in whom typical pernicious anæmia is present show a peculiar mental condition. Woltmann was, I believe, the first to point out that 'These patients are different in some way from other patients: they listen to what you say, they do not argue, they raise no objections; they are almost too good.' This writer is of opinion that some persons presenting such a character are really examples of pernicious anæmia without anæmia, but he does not make clear whether he believes that all such persons will ultimately develop the typical malady.

Very anæmic patients may present signs of extreme weakness of both body and mind, but much more distinctive psychical abnormalities may arise in persons whose blood shows but little deviation from normal, and yet cure of the hæmatological malady is followed by improvement in the mental state. Barrett pointed out that psychotic manifestations of paranoid type may occur in pernicious anæmia, and that the state is symptomatic of a toxic process affecting the central nervous system. The occurrence of such distinctive psychoses as manic-depressive insanity in pernicious anæmia is probably seen only in patients with a previous psychosis. Nevertheless Cornell points out that even such a mental condition may improve when the anæmia is adequately treated. Mathieu contends that definite mental abnormalities are most frequent during the terminal stages, but that they may occur at any period of the malady, and he agrees with Langdon that an apprehensive neurosis may be a manifestation of prepernicious anæmia. Émile-Weil and Cahen point out that mental changes may occur quite independently of the anæmia, and they describe a case in which such symptoms developed just after the beginning of liver treatment, but recovered when the blood became

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normal. They state that any form of alteration of character may be observed in pernicious anæmia; even dementia may develop. As a general rule, the mental condition is a depressive one, but excitations such as paranoia and mania have been seen.

Phillips has recorded three interesting cases, and calls attention to the fact that the onset of mental symptoms may coincide with the beginning of treatment, or may develop during treatment. He describes the case of a woman, aged 43, whose uncle had died of pernicious anæmia and who herself had suffered from ' neurasthenia ' for some years. In April, 1929, she had an attack of influenza and cystitis, and from then onwards complained of queer feelings in the head, insomnia and inability to concentrate. In October, 1929, she began to have delusions of persecution, and thought that her food was poisoned. In February, 1930, she was admitted to a mental home, and, at this time, she had 1,056,000 red corpuscles per c.mm., with 55 per cent. of hæmoglobin and 3,000 leucocytes per c.mm. She was treated with liver, liver extract, arsenic and hydrochloric acid, and by June, 1930, after gradual improvement, she became mentally normal; at this time there were 4,400,000 red corpuscles per c.mm., with 89 per cent. of hæmoglobin.

Phillips' second case differed from the one just described because the patient, aged 43, was diagnosed as suffering from pernicious anæmia at a time when she was an inmate of a mental home. Furthermore, one of her sisters was insane. The patient's physical and mental condition improved with liver treatment, but on discharge she ceased to take the liver and relapsed with delusions of persecution and both visual and auditory hallucinations. This would appear to be an example of a psychosis developing in a predisposed person; the attack of pernicious anæmia can be regarded as only an exciting cause.

It must be realized that similar mental states may occur in association with secondary anæmias. For example, Phillips' third case was a woman, aged 46, who had delusions of persecution and auditory hallucinations with confusion and depression, although her anæmia presented a low colour index. After three months' treatment she was discharged from the mental home apparently cured.

Unless it be realized that abnormal mental states may occur in pernicious anæmia, legal troubles may arise. For example, Hulett describes the case of an elderly man suffering from pernicious anæmia, who during the later months of his life turned against his devoted daughter, who had been his constant companion, and as a result disinherited her. Hulett was able to convince the courts that this particular form of psychosis is commonly met with in pernicious anæmia, and the will was declared invalid.

Naegeli mentions the case of a man who became so excessively brutal while suffering from pernicious anæmia that his wife was forced to divorce

him. He also refers to another case in which the patient stole billiard balls with no memory of the act afterwards.

It is rather tempting to suppose that the pathological changes underlying such mental states are similar in type to those occurring in the spinal cord in subacute combined degeneration, but there is no evidence to support this view. Woltmann states that organic changes in the cerebral cortex are just as well marked in pernicious anæmia with normal mentality as in those with mental disturbances, and he believes that one must postulate the existence of a toxin, which itself is ultimately also the cause of the terminal coma.

PERSONAL CASE.

The case which is recorded here is of interest in that complete physical and mental recovery took place.

D. S., a woman, aged 42, had been treated for 'neurasthenia' for some six months. Large doses of bromide had been given and, as the patient was never really quite awake, her husband thought that she was better. Her physical condition gradually deteriorated, and it became obvious to her relations that she was losing weight and becoming extremely pale.

She was admitted to the Chelmsford Hospital on November 12, 1931, and was seen to be wasted and to have a definitely pigmented skin. The face was distinctly brown in colour, but the pigmentation was not an even one: some areas were much paler than others. The skin of the chest and abdomen showed similar patchy pigmentation. Apart from a hæmic murmur, absence of the lower abdominal reflexes and pallor of the skin and mucosæ, no physical abnormality was detected on clinical examination.

The patient was peculiarly uncooperative, which is a feature emphasised by Richardson as being usual in cases of pernicious anæmia with slight mental change. Her uncooperativeness was peculiar in that it consisted in inability or disinclination to give information about herself; but, on the other hand, she was extraordinarily amenable and would obey instructions without any trouble. No other abnormality of conduct was observed during the first two days of her stay in hospital.

On November 14, her blood showed:—

Red corpuscles		2,880,000 per c.mm.
Hæmoglobin		62 per cent.
Colour index		1·08.
Leucocytes		2,200 per c.mm.
Neutrophils:—		
Young cells ...	0·5 per cent.	51·5 per cent.
Band forms ...	5·0 ,,	
Polymorphs ...	46·0 ,,	
Eosinophils		1·5 ,,
Basophils		0·5 ,,
Monocytes		13·5 ,,
Lymphocytes		32·0 ,,
Normoblasts		1·5 ,,

Polychromasia, punctate basophilia, anisocytosis and poikilocytosis: present, but not extreme.

Arneth-Cooke count: Class I 15 per cent.
,, II 42 ,,
,, III 35 ,,
,, IV 8 ,,

This gives a weighted mean of 2·46.

The average size of the red corpuscles was 8·39 μ.

It is clear that the blood picture is that of pernicious anæmia, and the only unusual feature is the high percentage of monocytes.

Intramuscular injections of liver extract (Exhepa pro injectione) for five successive days was ordered, together with six phials of Exhepa by mouth daily. After the second injection, that is on November 15, she appeared to be rather miserable, but no information could be obtained by questioning her. The next day she said she could hear voices outside her room and that these kept repeating that her husband had given himself up to the police. Her condition was peculiar in that there appeared to be no affective tone associated with the auditory hallucinations, and she was neither pleased nor distressed at the information; she lay quietly in bed and made no spontaneous remarks. If, however, she were asked a question, she did not, as a rule, reply to it, but promptly gave further information as to the voices. Occasionally she asked the nurse whether there was something wrong or whether she (the patient) had done something she ought not to have done.

On November 18, she made a fatuous attempt to cut her throat with the small blade of a blunt penknife, but only succeeded in scratching the skin. She was neither annoyed nor distressed when the knife was taken away from her.

She appeared to be rather lonely in her single room and, was, therefore, moved into the general ward. Unfortunately her bed was next to a radiator, and within a few hours of her transference to the ward she began to hear voices emerging from this, which she attributed to an arrangement on the part of the nursing staff, although she did not blame them or suggest that she would like to be moved. The voices now usually informed her that there was a large fire which had either burnt down her own home or was in process of destroying the War Office or Fleet Street. At no time during the day was she sensible and, as she slept badly, she continued her ramblings at night.

On the tenth day after starting treatment she became a little more responsive. If asked a question she might reply quite intelligently, although perhaps two or three minutes elapsed between the asking of the question and the commencement of the answer. Even so, she did not always reply completely; her answer might be interrupted by the voices whose information she then passed on to the questioner.

On the thirteenth day the Sister in charge of the ward was able to cut short the voices from the radiator by informing the patient that she herself or one of her nurses had put out the fire. On this day (November 27) the blood showed:—

Red corpuscles		3,100,000 per c.mm.
Hæmoglobin		68 per cent.
Colour index		1·09.
Leucocytes		5,600 per c.mm.
Neutrophils:—		
Band forms ...	6·0 per cent.	80·5 per cent.
Polymorphs ...	74·5 ,,	
Eosinophils		1·5 ,,
Basophils		0·5 ,,
Monocytes		10·0 ,,
Lymphocytes		7·5 ,,

The Arneth-Cooke count gave a weighted mean of 2·51; the average size of the red corpuscles was 8·19 μ, and polychromasia and punctate basophilia were well marked.

Although there was no great improvement in the number or quality of the red corpuscles, the presence of neutrophilia suggested that a remission was about to occur. During the next week the periods of 'listening in' to the radiator became shorter and less frequent, so that sometimes five or six hours would elapse before the patient again made any statement about the voices. Her physical condition was still poor, but was definitely improving and she was, therefore, allowed to get up and sit by the fire with the other patients at some distance from the radiator. At no time did she mention the voices when mixing with the other women, but when she returned to bed occasionally heard brief communications. Twenty-six days after the beginning of treatment she became perfectly normal and heard no further voices, but was still rather uncooperative. The next day she was almost talkative, but perfectly reasonable, with no apparent recollections of her delusions. She was discharged from hospital on December 19, 1931, with the following blood count:—

Red corpuscles		3,584,000 per c.mm.
Hæmoglobin		72 per cent.
Colour index		1·0.
Leucocytes		7,600 per c.mm.
Neutrophils:—		
Band forms	25·0 per cent.	75·5 per cent.
Polymorphs	52·5 ,,	
Eosinophils		0·5 ,,
Basophils		0·5 ,,
Monocytes		11·5 ,,
Lymphocytes		10·0 ,,

The Arneth-Cooke count gave a weighted mean of 1·61, platelets were very plentiful and polychromasia was well marked.

The high percentage of immature neutrophils suggested the possibility of a septic focus, but, as careful examination did not reveal one, it was presumed that this phenomenon was due to simple hyperactivity of the marrow.

An opportunity presented itself for the patient to have a holiday with relations, and she was, therefore, instructed to report in three weeks. As the response to liver had not been very good, the Exhepa was stopped and the patient was given desiccated stomach (Capsol Eugastrol) three times a day during her holiday. On January 9, 1932, her blood showed:—

Red corpuscles		4,840,000 per c.mm.
Hæmoglobin		98 per cent.
Colour index		1·0.
Leucocytes		5,000 per c.mm.
Neutrophils:—		
Band forms	7·5 per cent.	75·5 per cent.
Polymorphs	68·0 ,,	
Eosinophils		0·5 ,,
Basophils		1·5 ,,
Monocytes		5·5 ,,
Lymphocytes		17·0 ,,

The patient's general condition was now good, and she gained weight. There did not appear to be any recollection of her previous delusions. Pigmentation was still present, but was much less intense. Appetite and sleep were good, and

indeed no indications of illness were detected. The patient was seen again on March 5, 1932, and still appeared to be quite well. In September, 1932, she was still perfectly normal.

COMMENT.

It appears that it might be profitable to examine the blood in all cases of mental disorder in which there is even the slightest clinical evidence of anæmia. Unfortunately the number of cases of the present type recorded in the literature is still small, and it is therefore difficult to give any guidance as to prognosis, but the case described here shows that complete restoration may occur. It is particularly interesting to observe that the disappearance of the mental symptoms preceded the cure of the anæmia.

The very fact that suitable treatment of the blood may be followed by cure of the mental condition suggests that such patients should be kept in their own homes or in the wards of a general hospital for a month or two instead of being certified immediately. If this were done, much distress might be avoided, as presumably the considerable percentage of cases would be saved from the stigma of insanity. It seems almost certain that, if the pernicious anæmia and the mental symptoms have persisted for a long time, the latter will not respond to treatment, even if the former be adequately dealt with. In the last stages of a case in which treatment has been long delayed, complete dementia will inevitably develop.

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A CASE OF PARTIAL DEAFNESS SIMULATING CONGENITAL AUDITORY IMPERCEPTION.

By

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The problem presented by the case here reported was that of inability to use, utter or comprehend ordinary speech in a child clearly not mentally defective and apparently not deaf. Such cases being comparatively rare in an ordinary children's out-patient department, it was thought that it would be of interest to produce a series of tests which could be compared with those given by Worster-Drought and Allen[1, 2] to their case of congenital auditory imperception, a detailed account of which appeared in the *Journal of Neurology and Psychopathology*. Taking this report as a model, Head's[3] tests for use in cases of aphasia were given, and a comparison of the results is made later in the paper.

PERSONAL CASE.

The patient Ada W. is a girl who first attended the Children's Out-patient Department at King's College Hospital in January, 1931. She was then six years and ten months old and although lively and intelligent, and not apparently deaf, had never learnt to speak.

Family History.—She is the seventh of eight children. The mother was over 40 at the time of her birth, and labour was prolonged, due to atony. Non-instrumental delivery was effected, however, and the child cried normally. It is of interest to note that the younger brother, two years junior to the patient and the last of the family, is an intelligent child with a congenital right hemiplegia. There is no abnormality, either nervous or mental, in other members of the family or in near relatives.

Early History.—As a baby she 'took notice' in what was regarded as a normal fashion, turned her head when others entered the room, and walked when one year old. She is said to have learnt to say 'me' at ten months, but thereafter her speech failed to develop. She was easily trained in all toilet habits, and was otherwise a normal infant.

Past Health.—The usual fall on the head at eighteen months is reported but there is no history of any definite injury then or at a subsequent date. She has had bronchitis (two and a half years), whooping-cough (four years), diphtheria (five years). Measles at one year old is reported, but it was a mild attack and there were no aural or other complications.

When first seen the only complaint made was of dumbness. The child never spoke, but made several characteristic noises and sounds which she used as a language of her own. They were, however, not nearly so abundant as a corresponding vocabulary of a child of five would be. Her use of gesture was

quick and singularly vivid, and she turned her head when sounds were made behind her back. She appeared to hear the sound of her own voice, and made no grunts or spontaneous noises of which she seemed unaware. Her movements were quick and neat and there was no shuffling of the feet in walking. Her mother reported that she varied in her response to sounds: if she were busily occupied with something else she would not notice or appear to respond to a sound stimulus, but if she were listening or not so preoccupied, she appeared to hear all ordinary noises. Like the case reported by Worster-Drought and Allen, however, she appeared much less interested in sounds than in any other form of stimulus. Her powers of noticing and interpreting gesture were abnormally quick, and it was noticed that even at the age of five she watched intently the lips of those speaking to her. Her behaviour with other children was normal, and six months away from home with relatives had made no difference; she had then taken quite kindly to a family of young cousins.

On examination it was found that her tonsils were enlarged and septic and that adenoids were present. Although there was no evidence of middle ear disease, no detailed investigation was undertaken until these had been removed by operation.

She was seen again in February, 1931, three weeks after operation. She was small for her age, but her physical condition appeared to be excellent. It was thought that her hearing in the right ear was not so good as the left, but it was difficult to be sure of her replies. She was clearly not grossly deaf in either ear. All other cranial nerves were normal, and all reflexes were normal. There was no nystagmus, no incoordination, and tests for vestibular function gave a normal result.

Her voice was somewhat hoarse, possibly from disuse. Her articulation was indistinct, and her vocabulary limited to a few simple words such as 'Mummy,' 'pussy,' 'yes,' 'no,' 'no more,' and her name 'Ada.' These were quite intelligible, but she used no sentences and expressed herself without words by means of gesture. At school (ordinary elementary school) which she had attended since the age of five, it was reported that she would copy letters, but could neither read, nor write to dictation. She had learnt to count up to eight, but could not manipulate numbers in simple sums. To a Burt revision of Binet Simon test, she gave a normal response with an intelligence quotient of 95.

Clearly then, the speech defect could not be attributed to retarded mental development, and a functional mutism of such severity and consistency would hardly be postulated. In addition there was no trace of hysterical behaviour in the child.

The question of deafness had clearly to be eliminated and the difficulty of this task in a young child, inattentive to and uninterested in aural stimuli, can hardly be exaggerated.

On examination the external ear was normal, the drums were intact and unscarred, but somewhat retracted on both sides. She appeared to hear a tuning-fork (C 2) in both ears, by air and bone conduction, but it was noted that there was some loss in the right ear as the intensity diminished. This was not definite enough for a comparison with a normal ear. She turned her head rapidly to all sounds such as knocking, clapping hands or dropping objects behind her back. If her name was spoken she looked up. There was no question, however, that she understood commands more easily if the speaker's lips were visible. All vestibular tests as noted above were normal, and she showed none of the customary behaviour traits of the deaf child such as shuffling feet in walking. A provisional diagnosis of congenital auditory imperception was therefore made.

In July, 1931, arrangements were made for her to be transferred to a residential school for the deaf as it was felt that her knowledge would have to be gained by other channels than her ears, even though her capacity to hear appeared good.

In January, 1932, she was seen again, and although only seven years and ten months old, she appeared so lively and intelligent that arrangements were made to take her into hospital next school holiday and try detailed testing according to Head's scheme for aphasics. On this occasion she was seen by the aural surgeon who reported as follows: 'This child is by no means deaf. She can hear and localise loud noises. She can hear musical notes, particularly in low tones. Bone conduction to the low forks is good, and gets worse as the pitch is raised.'

In view of this report, the question was raised whether the case could be an instance of high frequency deafness. In many respects she answered to Ewing's[1] descriptions of such cases, with their 'bird-wittedness,' but without more elaborate apparatus it was agreed that such a diagnosis could only be queried. At this time (January, 1932) her mother reported that the child had learnt a good deal from school; sewing, knitting and writing when limited to copying, and drawing, were all good. She would tell the different colours and named them by signs according to a deaf-and-dumb language. She would count up to 12. The night before, at home, she had said spontaneously, 'Uncle Ted coming tomorrow,' having been told that this was so earlier in the day. But her mother observed, 'She has no sentences in her, and if she sings, it's all gabble.' Her hearing appeared to be about the same; 'She'll take notice if she's not thinking of anything, but if she's busy with anything she won't hear you.' Her behaviour was noted to be somewhat self-willed and impetuous. She had cried for two hours because she had to put on black stockings for hospital.

On this occasion she was shown a number of simple objects; these she named in an idioglossic language which, however, bore in each instance a recognizable relationship to the proper name—for example, pencil was 'betsu.' She played happily with pencil and paper and drew myself and her mother, putting in distinguishing features with great glee and commendable aptness. She drew a table with cups and saucers, tried to draw milk in the jug, gave it up, and mimicked pouring it out to show what had been intended. During this time her mother made several gentle noises which were not sufficient to attract her attention. She copied a clock face and named the numbers correctly, but mispronounced her words in a way difficult to reproduce—for example, 'twelarve' for 'twelve.' These numbers she would write to dictation, in figures, and also her own name. Reading from dictation was very poor; 'cat' and 'Ada' and 'pen' were all she could read. Results were sufficiently good, however, to indicate that more might be learnt from applying a more detailed test.

Accordingly she was seen again in April, 1932. Another intelligence test consisting of performance tests gave a result indicating an intelligence slightly above normal. Her impetuous haste and lively interest in the material sometimes spoilt her result because of premature replies and the difficulty experienced in explaining the tests with gesture only.

The following results were then obtained by applying the series of tests described by Henry Head in the investigation of aphasia. The variation introduced in their paper by Worster-Drought and Allen was used in most cases—that is, naming the object first with the observer in sight, then repeating with the observer's lips invisible to the patient. In the list of common objects, for convenience' sake, a spoon was substituted for scissors.

TABLE

TEST 1.—NAMING AND RECOGNITION

Object.	(1) Pointing to an object on the table which corresponds to one shown	(2) Pointing to an object named verbally by the observer (in sight).	(3) Pointing to an object named verbally by the observer (out of sight).	(4) Pointing to an object named in print.
Knife	correct; rapid	correct	no response	correct
Key	,, ,,	,,	said 'bee' then chose correctly	,,
Penny	,, ,,	,,	chose match	chose match
Match	,, ,,	,,	no response	,, pencil
Spoon	,, ,,	,,	chose key	,, key
Pencil	,, ,,	tried knife, then key, then correctly chose pencil	chose knife, then key, then laughed, said 'betsu,' chose correctly	,, spoon
Key	,, ,,	correct	chose knife	,, knife
Spoon	,, ,,	,,	correct	correct
Match	,, ,,	,,	correct	chose knife
Knife	,, ,,	,,	hesitated then chose correctly	correct
Penny	,, ,,	,,	chose key, then guessed at random and further answers became valueless	said 'betsu,' then chose correctly
Match	,, ,,	,,	,,	chose key, then guessed at random
Spoon	,, ,,	,,	,,	puzzled; no choice
Pencil	,, ,,	,,	,,	chose key
Penny	,, ,,	,,	,,	,, match
Knife	,, ,,	,,	,,	correct
Key	,, ,,	,,	,,	,,
Match	,, ,,	,,	,,	,,

1.

OF COMMON OBJECTS.

(5) Duplicate placed in left hand (out of sight).	(6) Naming an object indicated.	(7) Writing the name of an object indicated.	(8) Writing the name of an object indicated. (Test repeated on another day.)
correct; rapid	libow	Aat	AEGK
,, ,,	ee-er	Wrtse	KOY
,, ,,	malis (? moneys)	London	GIHWT
,, ,,	mach	Watts	KODWIHMN
,, ,,	boo-er	Aartal	IOGHTWMNYT
,, ,,	betsu	Yiboots	HOWg
,, ,,	ee-er	Wrtse	KOY
,, ,,	boot	London	IOGHTWMNYT
,, ,,	bach	Aat	KODWIHMN
,, ,,	lievah	Watts	GHIWT
,, ,,	malis	Aartso	OIWT
,, ,,	mach	Aat	OHLLW
,, ,,	bloodah	Wrtse	HEF
,, ,,	betsu	Yiboots	REWOT
,, ,,	maris	Wrtse	GRFE
,, ,,	liebow	London	THG
,, ,,	ee-er	Aat	WDRE
,, ,,	mach-er	Aartse	OEhat

TABLE

TEST 2.—NAMING AND

Colour.	(1) Pointing to similar colour to that shown.	(2) Pointing to colour named by observer (visible).	(3) Pointing to colour named by observer (hidden).	(4) Pointing to colour named in print.
Black	correct and rapid	correct and rapid	correct and rapid	chose orange
Red	,,	,,	,,	correct
Blue	,,	,,	,,	,,
Green	,,	,,	,,	,,
Orange	,,	,,	,,	,,
White	,,	,,	,,	,,
Violet	,,	,,	,,	,,
Yellow	,,	,,	,,	,,
Red	,,	,,	,,	,,
White	,,	,,	,,	,,
Yellow	,,	,,	,,	,,
Blue	,,	,,	,,	chose black
Green	,,	,,	,,	correct
Black	,,	,,	,,	chose orange
Orange	,,	,,	,,	correct
Violet	,,	,,	,,	,,

2.

RECOGNITION OF COLOURS.

(5) Naming colour shown.	(6) Writing name of colour indicated.		(7) Printed name read aloud.
	16.4.32.	repeated 19.4.32.	
said ' black '	blulo	balle	read ' blaa '
' whrada '	red	red	' rhée ' (as in French ' créme ')
' blulo '	lube	bube	' bloo-ah '
' whree-er '	green	green	' whree-er
' orvish '	orntow	oriREtaeEF	' orvish ' (and imitated sucking an orange)
' wyjo '	Wratooln	Wattaer	' belahtay '
' valt '	AERoot	Wratt	' wahta '
' djallow '	Yellow	Yellow	' djallow '
' whrada '	Red	Red	' whraya '
' wyjo '	wratooln	wratt	' blattaya '
' djallow '	Yellow	Yellow	' djallow '
' blulo '	lube	bube	' bloo-ah '
' whree-er '	Green	Green	' whree-ah '
' blaat '	blulo	Balle	' blatta '
' orvish '	orntow	oriREtaeEf	' orvish '
' Valt ' but hesitated and did not appear to know the word	Wratooln	Wattaer	' weissa '

TABLE

TEST 3.—THE MAN, THE

Test applied.	(1) Reading aloud.	(2) Reading from pictures.	(3) Writing from pictures.
The dog and the cat	wow-wow; alaati	correct and quick	dog cat
The man and the dog	bata; wow-wow	,,	eng dog
The cat and the man	alaati; bata	,,	cat eng
The cat and the dog	alaati; wow-wow	,,	cat dog
The dog and the man	wow-wow; bata	,,	dog eng
The man and the cat	bata; alaati	,,	eng cat
	(occasionally mixed 'vee' for 'the,' but made no other attempt at reproducing in the form of a sentence)	(but used her own terms throughout. These the same as in previous column)	

3.

CAT, AND THE DOG TEST.

(4) Writing from dictation (observer visible).	(5) Writing from dictation (observer not visible).	(6) Repetition (observer hidden).	(7) Reading what she has written.	(8) Copying.
CAT	dog	ve wow-wow	correct	correct and rapid
dog	CAT	alaati		
ACA	ACA	bata. ve	,,	,, ,, ,,
dog	dog	wow-wow		
CAT	CAT	alaati	,,	,, ,, ,,
ACA	ACA	ve vata		
CAT	dog	alaati	,,	,, ,, ,,
dog	CAT	ve wow-wow		
dog	ACA	wow-wow	,,	,, ,, ,,
ACA	dog	bata		
ACA	CAT*	ve bata	,,	,, ,, ,,
CAT	dog	alaati		
	*(heard last word clearly and wrote 'cat' at once. Then sat and puzzled and then wrote 'dog')		(Using her own terms as in previous column)	

TEST 4.—THE CLOCK TEST.

The first test, that of direct imitation, was performed correctly and rapidly. On attempting the succeeding tests it became clear that the patient could not tell the time in the ordinary way, although she knew and understood the numerals (arabic but not roman) and could arrange these in order.

For instance when told to set the clock at 1.10 she tried each finger singly,

TABLE

TEST 5.—THE COIN

Command.	(1) Oral command (observer in sight).	(2a) Written command using figures, e.g., 2nd into 4th.	(2b) Written command using words, e.g., second into fourth.
Second into third	correct	Third into second	correct
First into third	,,	correct	doubtful: made no response
Second into first	,,	First into second	hesitated, tried third into fourth
Third into second	,,	correct	tried first into third
First into fourth			Subsequent replies
Fourth into third	,,	,,	became quite ran-
Second into fourth	,,	,,	dom and it was
Fourth into first	,,	,,	obvious that the
Third into first	,,	,,	patient was guessing,
First into second	,,	,,	i.e., she knows the
Third into fourth	,,	,,	figures but not the
Fourth into second	Second into fourth then corrected it to fourth into second		words for numerals

first at 1, and then at 10. Then in all subsequent tests she decided to regard the big finger only, e.g., when given the clock set at 1.55, she called it eleven, and when given the printed command 2.55, she set the big finger at 2, and paid no attention to the position of the small finger.

The test, therefore, appeared to be valueless, except in showing that she recognized both the sight and sound of numerals.

4.

AND BOWL TEST.

(3a) Command read aloud by patient from figures.	(3b) Command given her to read fully written out in words.
correct	could not read it, therefore no attempt made
"	"
"	"
"	"
"	"
"	"
"	"
"	"
"	"
"	"
"	"
Her articulation lacked clearness and she said 'one-er,' 'four-er,' and 'penna' for penny. She attempted no sentences	

TABLE

TEST 6.—THE HAND.

Movement.	(1) Imitation of movement made by observer.	(2) Imitation of movements of observer seen in glass.	(3) Carrying out pictorial commands.	(4) Pictorial commands seen in glass.
L hand to L eye	correct	correct	*R hand to R eye	correct
R hand to R ear	,,	,,	*L hand to L ear	,,
R hand to L eye	,, (slight movement to R eye checked)	,,	*L hand to R eye	L hand to R eye
L hand to R eye	R hand to L eye	,,	*R hand to L eye	correct
L hand to L ear	correct	R hand to R ear	*L hand to R eye	,,
R hand to R eye	,,	correct	correct	,,
L hand to R ear	,,	,,	,,	,,
R hand to L ear	,,	,,	,,	,,
L hand to L eye	,,	,,	,,	,,
R hand to R ear	hesitated, then correct	,,	,,	,,
R hand to L eye	correct	,,	*L hand to R eye	,,
L hand to R eye	,,	,,	*R hand to L eye	,,
L hand to L ear	,,	,,	L to (1) R eye (2) R ear	,,
R hand to R eye	,,	,,	correct	,,
L hand to R ear	,,	,,	,,	,,
R hand to L ear	,,	,,	L hand to R ear (*spontaneous correction followed immediately)	,,

5.

EYE AND EAR TEST.

(5) Oral commands (observer visible).	(6) Printed commands not read aloud.	(7) Reading aloud and executing commands.	(8) Writing down movements made by observer.
R hand to (1) R ear (2) R eye	R hand to L eye	correct	Patient could make no attempt at this.
L hand to R ear	R hand to R eye	,,	
L hand to L eye	R hand to R eye	,,	
correct	L hand to L eye, followed by rapid alternation	L hand to L eye	
R hand to R ear	L hand to R ear	correct	
L hand to L eye	R hand to L eye	,,	
L hand to L ear	R hand to R ear	,,	
correct	R hand to R ear	,,	
R hand to R eye	correct	,,	
L hand to L ear	,,	R hand to L ear	
L hand to R eye	R hand to R ear	correct	
R hand to L eye	L hand to L eye, followed by R hand to R eye	,,	
R hand to (1) R eye (2) L eye (3) L ear	correct	,,	
L hand to L eye	R hand to R ear	,,	
R hand to L ear	correct	,,	
L hand to R ear	,,	,,	

TABLE 6.

TEST 7.—THE ALPHABET.

	(1) Repeating letters.	(2) Repeating letters after observer (seen).	(3) Repeating letters after observer (not seen).	(4) and (5) Writing from dictation.	(6) Reading letters.	(7) Arranging letters in order.
A	Patient has	ayt		Writing from	no reply	Had no idea
B	not learnt the	bee		dictation	,, ,,	how to arrange
C	alphabet as	tee		failed because	,, ,,	letters in order
D	such, and she	ee		she appeared	,, ,,	
E	failed to re-	ee		not to have	ee-er	
F	peat it in	af		learnt yet	no reply	
G	order what-	khee		to correlate	,, ,,	
H	ever method	aych		sounds with	sh	
I	was tried to	aier	aiee	symbols	no reply	
J	set her going	chay			,, ,,	
K		gal	hase		ka-ka-ka	
L		el			no reply	
M		em	esj		mm	
N		en			no reply	
O		oh			,, ,,	
P		bee	gee		pu-pu	
Q		choo	yover		no reply	
R		ar			,, ,,	
S		rouse	es		sss	
T		tee			te-te	
U		yoo	yover		no reply	
V		viz			,, ,,	
W		dubberzoo			w-w then said twelabees	
X		az			no reply	
Y		wise			,, ,,	
Z		zisala	zell		,, ,,	

Note: In column (3) the sound is only indicated when it differed materially from those in column (2). In the blank spaces the sound made by the patient was the same with the observer seen and not seen.

CALCULATIONS.

In these the patient was asked to add the figures, and her results are shown with the corrections she made herself. She worked from left to right, and does not appear to understand the significance of the position of the numeral indicating tens or hundreds.

She does not know how to subtract or divide.

ADDITION.

1.	2		
	4		
	7	(6)	
2.	3		
	5		
	8		
3.	1 5 7		
	6 3 2		
	10 8 9	(7 8 9)	
4.	2 3 7		
	1 4 5		
	3 7 11		
5.	4 3 6		
	2 8 1		
	6 11 7		

A detailed comparison of these results with those of Worster-Drought and Allen was made, the actual number of correct and incorrect replies, and the nature of the error compared in each instance. The language ability generally, especially in tests which involved reading written commands, was poorer in this case, but here the difference in age, and consequently in the length of time spent at school, may afford an explanation. Otherwise the only outstanding difference is in Test 2, Table 2 (naming and recognition of colours). My patient appeared to be more familiar with both the sounds and the appearance of the words for the common colours, and her spoken idioglossic terms are in most cases only a distorted attempt at the correct pronunciation. Both in this test and in that preceding it the words written by the patient bear no relation to the sounds she made in naming the colour, and the impression was given to the observer that the child merely wrote down at random a series of letters, having found by experience that was what was expected of her. Her intelligence was sufficient to enable her to use the

same ' word ' several times for the same object, but when the test was repeated at a later date a totally different ' word,' i.e., series of letters, was supplied. This point is stressed as being of some interest and importance, and whether the same might not apply to some of Worster-Drought and Allen's results is queried, for example HSTG for ' red.' After all, if the child has no knowledge of the ordinary system of phonetics in use in our language, and has not learned to associate certain sounds with certain symbols, why should he be able to make a coherent attempt at spelling his own idioglossic tongue?

A NEW TEST.

After the completion of these tests, another was devised which aimed at investigating not only her ability to hear, but also to distinguish and recognize different qualities of sound, and to estimate her capacity to remember and associate a given sound with the object which made it. This test was applied on April 23, and repeated as detailed on May 5, 1932 (Test 8).

Six objects, each making a characteristic sound, were shown to the patient. It was ascertained by signs that she could hear each sound, and she was allowed to handle, sound and play with each one. These were:—

(1) An ordinary umpire's whistle with a fairly shrill, high note = *whistle*: (2) A small table dinner-gong, with a low booming note = *gong*: (3) An improvised rattle made from an ordinary (empty) cocoa-tin with two lumps of sugar in it = *tin*: (4) A child's toy trumpet sounding three notes in harmony = *trumpet*: (5) A small table bell of brass, with a clapper. This gave a note of moderate pitch and intensity = *bell*: (6) A toy telephone, with a handle at one side which when turned rang a small high-pitched, rather ' tinny ' bell, something similar to the bell of a small alarm clock = *telephone*. This sound was the least intense of any. She was then, by means of signs, told to draw each of these objects, making sure that she recognized and identified each one with its own sound. The first drawings were made with the objects in situ, and she was highly amused at this part of the procedure.

For the first time through she had in front of her her own sheet of drawings, as it appeared a considerable feat to draw entirely from memory so complicated an object as a toy telephone or dinner gong. It was noticeable that her drawings showed a progressive simplification and omission of detail, but each one retained sufficiently characteristic features to be easily identifiable. She then sat down to a desk with paper and pencil. The objects were hidden from her behind a cloth-covered screen, and, in the order below, were sounded, each at an average, and as far as possible constant, intensity. The test consisted in getting the patient to draw the appropriate object as soon as she heard and recognized the sound made by the observer behind the screen. There was never any doubt of her ability to hear each sound stimulus, and she listened attentively, her face lighting up as she recognized it. It was clear that the louder the sound, the easier she found it to recognize, e.g., the toy telephone gave her the most trouble, this sound having both the highest pitch and least intensity.

TABLE 7.

TEST 8.—THE SOUND TEST.

Object.	First time through.	Second time through.	Nine days later.
Whistle	drew whistle, i.e., correct	correct	correct
Gong	correct	,,	,,
Tin	drew telephone	,,	,,
Trumpet	correct	,,	,,
Bell	,,	,,	,,
Telephone	,,	hesitated and had to have it sounded a second time	,,
Gong	,,	correct	,,
Trumpet	drew whistle, then laughed and pointed to her original drawing of trumpet in correction	,,	,,
Bell	correct	,,	,,
Whistle	,,	,,	,,
Gong	,,	,,	,,
Tin	,,	,,	,,
Telephone	drew bell	,,	,,
Trumpet	correct	,,	,,
Bell	,,	,,	,,
Tin	,,	,,	,,
Telephone	hesitated: drew bell	,,	,,
Whistle	correct	,,	,,

Between the first and second time through, both of which were given on the same day, she was allowed practice with the sounds she seemed to find most difficult, either because of similarity or low intensity. These were the telephone and the bell, i.e., telephone was sounded and patient drew bell. Bell was then sounded, and again patient drew bell. She was then shown objects again, and tried again, but repeated her mistake and seemed to be getting a little fatigued or bored. She was then given the sound of the tin and drew gong. The screen was then withdrawn, so that she could see all the objects, but still she pointed to the gong. She was then made to sound it, and was comically surprised at the 'wrong' sound, and immediately, without any further sounding, she picked out correctly the tin. When the test was repeated at a later date, the utmost care was taken that no sound should be made by any of the objects while exposed to view. But in order to refresh her visual memory they were shown to her grouped on a tray. They were then again hidden by the same screen, and sounded through in the order as before, and she drew, each time correctly, the object corresponding to the sound made.

It would be of great interest to repeat this test with a genuinely aphasic child, as it appears to afford a better method of estimating the patient's ability to associate sound with a variety of 'meaning' than do words in a

child who has not learnt to use them, although the test appears clearly to be one of memory rather than comprehension. A somewhat similar test was applied by Morison[3] to his case, the auditory acuity for sounds being tested by counting the number of soft peals of a bell and the number of times the fingers were snapped. His patient recognized a mew, a bark and a low, although no details are given as to how the test was made. Although able to do all this correctly, Morison's patient made no response to words.

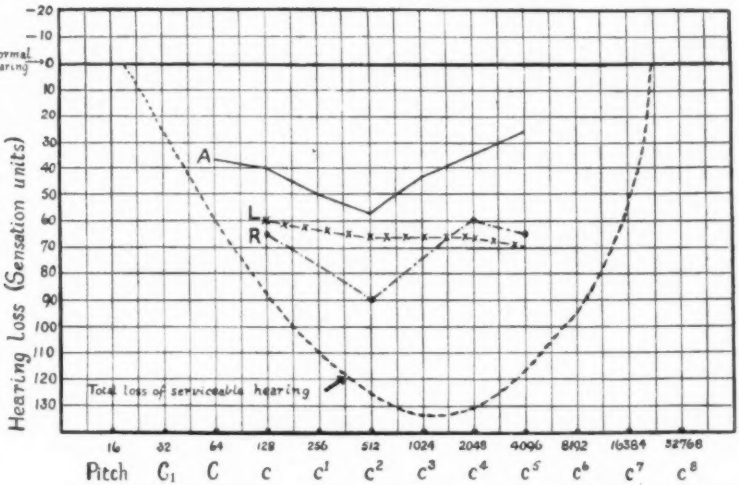
> At the conclusion of these tests, the patient was given paper and pencil on several occasions in order to draw objects in front of her, and pictures from imagination. Her reproduction of objects was usually accurate and showed that she observed carefully any characteristic features, but on two occasions she showed a tendency to a form of mirror drawing in which the direction of converging lines, thus /\ were reproduced \/. This was shown in her drawings of an inkwell, and of a small calendar on a stand. Her spontaneous drawing consisted of flowers standing in front of a scribble she called 'wahtah' (? water). She then drew in dots all over this, and indicated by pointing out of the window, where it was raining, that these indicated raindrops. She described this picture by a phrase which sounded like 'evadnayow.'
>
> Her behaviour with a piano was of some interest. She played with it, and heard the sounds made by various notes, but did not betray the usual pleasure of a child allowed to strum. She does not sing spontaneously, and on getting her to listen and copy a note played or sung by the observer on a definite vowel sound, as for example 'oo' on middle C, she would sometimes pitch it correctly but often not. Her attempts to sing simple intervals e.g., Doh-mi-soh, after hearing them played on the piano, failed at first, but she showed improvement with practice. Some evidence was thus afforded that she hears and discriminates between sounds, and that she can hear her own voice.
>
> At this time, May, 1932, her ears and hearing were tested again, and as before the only unequivocal sign elicited was an increase of bone conduction over air conduction. The extent to which air conduction was reduced was impossible to ascertain owing to her uncertain and variable replies. Weber's test was referred to the right and her hearing appeared to be better in her left ear, although again no gross hearing loss could be demonstrated by ordinary means. Vestibular tests in a rotating chair were normal, typical nystagmus occurred and the head was held inclined to the side at the end and immediately after rotating in the chair. On recovery from the test, she was able to walk straight with open and closed eyes, and caught a ball neatly and accurately. Dr. F. L. Golla, who saw the patient and performed the tests, was satisfied that there was no impairment of vestibular function. The aural surgeon's report on April 25 gave as an opinion, that the case was one of congenital aphasia 'which had been made worse by Eustachian obstruction and resulting retraction of membranes. Hearing is better than when I last saw her, particularly does she hear the lower-pitched sounds.' Inflation was regarded as out of the question owing to the difficulty of obtaining cooperation in so young a child.

THE AUDIOMETER TEST.

While investigating this case, an opportunity occurred to have the child tested by Dr. A. W. G. Ewing, using his special adaptation of the Western Electric (2A) audiometer. The technique of this hearing test is fully described in Ewing's work on aphasia, and more briefly in a recent article in

the *British Medical Journal*[6]. The outstanding points are that a sound stimulus is given consisting of a pure tone, and that this is heard by the subject through an ear-phone applied in succession to either ear. The instrument carries a range of octaves and each note can be sounded at different intensities by means of varied resistances, thus covering the range of the human voice. The child was instructed by means of dumb show to press a button as soon as any stimulus was perceived. Her ready interest in this test demonstrated her ability to comprehend the instructions and her replies were every time consistent, a check being introduced by testing down from a clear stimulus to the point at which this became inaudible, and on the second time through, working from silence to the first perceptible sound.

AUDIOGRAM OF ADA WRIGHT, APRIL 18, 1932.



Line at 'A' indicates reading of audiometer when testing a person of normal hearing with the D·80904 conduction receiver.
L = Left ear of patient. R = Right.

The result of this test was to demonstrate convincingly the presence of a moderately severe degree of deafness, resulting in partial hearing loss over a large field (see fig.).

The chart indicates the condition graphically, and Dr. Ewing's comment was as follows:—'Audiometer test indicated 50-60 per cent. hearing loss for speech. Readings from left ear were better than right. Tests with the human voice afforded corroboratory evidence. This degree of deafness, where the trouble is of early incidence, usually results in the child making few and imperfect attempts to speak. In my opinion this severe deafness is the sole cause of the speech difficulty.'

The whole aspect of this case was, therefore, altered and it appeared merely as if a mistake in diagnosis had been made due to lack of ordinary care. On reflection however, certain points emerged which appear to be of interest, and possibly of significance in the consideration of other similar cases.

DISCUSSION.

All authorities are agreed that for young children tuning-fork and other hearing tests are highly unsatisfactory. On three occasions this child was tested by experts, and on many others observed in her reactions to sounds, and a unanimous conclusion was reached that she was not seriously deaf. That some alteration was present was agreed, and on the first occasion she was seen her enlarged and septic tonsils and adenoids were noted, together with the retraction of the tympanic membranes. But this state was not regarded as a possible explanation for the whole of her disability, and while there is some evidence to suggest that the lesion is not congenital, there was no illness or inflammatory disease noted to account for the severe deafness demonstrated by Ewing's method. The pathological nature of the condition, therefore, remains an open question.

In this child the outstanding disability was in connexion with speech, on both the motor and receptive side. This was in contradistinction to her apparent alertness in response to sounds or mere noises. Even her mother thought she could 'hear' speech because of the frequency with which the attention could be gained by a loud call. The fact that she apparently heard without understanding, unless in a position to lip-read, was the feature which first led to the investigation of the case. That she can, however, both hear and understand words with which she is familiar is shown in some of her responses, e.g., in naming colours (Test 2, Table 2, column 3). This brings up the question of distortion and its bearing on the phonetic system of language training.

Ewing and others have demonstrated, by means of phonograph records, the speech of an ordinary human voice as it sounds to the partially deaf person. Although clearly audible it is quite unintelligible owing to confusion of many of the vowel and consonant sounds. A similar experience is met with by the normal person in listening to a faulty wireless announcer, or a poorly connected 'phone call. The repeated 'I can't hear you' should really be 'I can't distinguish what you say.' The difficulty in acquiring speech results from this confusion, but it is nevertheless remarkable that a faculty so universally developed with so little conscious learning or teaching should be almost totally absent as the result of this defect alone.

A further point of interest is that the 'aphasia' resulting in this child appeared in no essential to be different from the aphasia described in their case by Worster-Drought and Allen, although there the defect was postulated

as a central defect, and here it was discovered to lie in the peripheral sense-receptor. It should be noted, however, that the tests employed were devised for the investigation of a previously normal function now destroyed, while here they are used, perhaps less legitimately and less effectively, in cases where speech has failed to be acquired. The results of the discrimination between different sounds, not related to words (Test 8), appear to have a definite bearing on this point, and it would be interesting to repeat a similar test on genuinely aphasic children, that is to say, on cases of congenital auditory imperception.

In comparing and contrasting this case with others of congenital aphasia, idioglossia and congenital auditory imperception reported in the literature, certain points appear to be outstanding. Firstly with regard to the question of deafness, in nearly every case some note is made to exclude this, but little or no account is given of actual tests, except in the case of Worster-Drought and Allen. Their case was examined in detail, and hearing appeared to be normal, but a possibly scarred tympanic membrane and two operations for the removal of adenoids in early life are noted. At three, their patient had a fall after which there was ' a discharge of watery fluid and blood ' from one ear. These authors also note that ' there is a certain lack of appreciation of the exact nature of the sounds he hears, as he occasionally repeats the words imperfectly, and at times fails to repeat musical notes correctly, though at other times he can do so.' McCall's[7] case was described as a mouth-breather who had adenoids, and a peculiarly intoned speech. The child depended on lip-reading and was noted to turn towards a noise, rather than in response to speech. Bronner[8] comments on this case and two others reported by Thomas[9], also two cases reported by Town[10], in all of which reasonable doubt might be thrown on the condition of the auditory fields in the early years of life. In Wilbur's[11] ten cases, eight have other physical or mental defects, including one with ' scrofula.'

In this connexion it is interesting to compare this case of Wilbur with that of a child of three, Pauline H., who was admitted to the Maudsley Hospital suffering from ' dumbness ' following a shock. She was found to have enlarged tonsils and cervical glands, and subsequently developed a severe adenitis, requiring opening and draining, and double otorrhœa. She indicated her wishes by signs, and made no attempt to speak, and her cry had a peculiar monotonous, almost brassy intonation. It was difficult to ascertain how well she heard, but on one occasion she was seen to turn round and indicate that she had heard a local school bell ringing for the children at 9 a.m. She has since recovered completely, and is now speaking normally; but whatever hearing loss she had, it was severe enough to cut short for nearly 18 months her entire speech development, and indeed she ceased to use those words she had already learnt. This case would seem to

afford suitable material for comparison with a case reported by Drinkwater[12], in which there was a period of temporary severe deafness which, on clearing, left an inability to understand speech. This is ascribed to ' word-deafness,' but might surely also be due to residual deafness producing distortion. In another of Wilbur's cases, he speaks of the speech disability being associated with partial deafness, and in another with ' deafness in the perceptive ear.' In Macready's[13], Kerr's[14], Haddon's[15], Taylor's[16], and Sainsbury's[17] cases, only brief reference is made to the examination of the ears and hearing.

Bronner[8] notes the frequent association of behaviour problems with such individual defects as these in children who are otherwise not backward in general mental ability. Ada W. has never shown any antisocial behaviour, but she shows to some extent the ' bird-wittedness ' and hasty impetuous temper which Ewing regards as somewhat characteristic of his cases of high frequency deafness.

The familial character of the defect is brought out by Worster-Drought and Allen, Barton Hall[18] and Morison[5], and E. B. Macready[19] speaks of such cases as biological variants. In this family, there is no known difficulty in acquiring speech and no familial deafness. But if the deafness in this case were congenital, it is of interest that the only younger sibling shows a more severe defect in his congenital hemiplegia. Such associated anatomical defects and peculiarities such as left-handedness and supernumerary digits, noted by Sainsbury and Haddon, are not present here.

In those cases in which especially the idioglossia is studied, there does appear to be a certain similarity in the speech. L. Guthrie[20] points out, however, that all examples of idioglossia are but imperfect attempts at correct pronunciation, so that a similarity would be expected. The extreme difficulty in transcribing the speech of these children makes a more accurate analysis of their own individual words a very difficult matter. The frequent addition of a suffix ' -er ' in this case is very noticeable, as in ' chree-er ' and ' bloo-er ' for ' green ' and ' blue,' and this same peculiarity is also noted in Taylor's case.

In conclusion this case indicates the degree to which crippling deafness in young children may be overlooked or underestimated when looked for, and further, that such deafness may be congenital or may at all events exist without any observed pathological cause. These children may show responses to sounds, especially loud noises, while appearing to be deaf to ordinary human speech, and this led, in the case here described, to a confusion between ' word-meaning deafness ' which is regarded as a central lesion, and is the characteristic feature of true congenital auditory imperception, and a lowering of auditory acuity, which was great enough to prevent the acquisition of language by an otherwise intelligent child. It is suggested that the distortion of speech which occurs in the partially deaf is a sufficient

explanation of this feature. It is not suggested that cases of congenital auditory imperception do not occur, in which a complete failure to understand and acquire speech coexists with a perfectly normal range of hearing. Such a case is quoted by Ewing, and the results of an audiometer test are described in detail. Some cases reported in the literature, however, are suggestive of a partial hearing loss occurring in early life, and some designated 'aphasia' actually describe some degree of deafness. In this connexion the unsuitability of tuning-fork tests for young children is evident, particularly as these children are inclined to acquire the habit of not listening to sounds. Instead they learn to lip-read, and whether the defect is central or peripheral, they depend increasingly on visual memories for the acquisition of language. The use of the audiometer in preference to any form of tuning-fork is stressed by Ewing, and a recent communication from the Institute of Hygiene and Tropical Medicine[21] suggests that this form of testing will come to be increasingly used.

SUMMARY.

A case is described of difficulty in acquiring and understanding speech in an intelligent child of eight years.

A detailed examination of language capacity was made with Head's tests for aphasia, and others were introduced to test the accuracy of auditory perception and the ability to retain auditory memories.

The results of aural examination by ordinary (tuning-fork) and special (audiometer) methods, are described, and the results contrasted.

A comparison is made with this case and others in the literature, with particular reference to that reported by Worster-Drought and Allen.

I am grateful to Dr. W. P. Sheldon, in whose clinic the case was first seen, and to Dr. Mapother, Medical Superintendent of the Maudsley Hospital, for permission to publish this case. I would like also to acknowledge the kindness of Dr. and Mrs. Ewing in making possible the audiometer tests.

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THE LESIONS PRODUCED IN THE BRAIN OF RABBITS BY THE INJECTION OF INDIAN INK AND OF ARGYROL.

By

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It has been shown that after the injection of organisms into the general circulation of rabbits definite lesions are found in the nerve-cell laminæ of the brain[1]. These lesions are necrotic, but all areas are not involved to the same degree. The fornix shows the maximum of damage; here the necrotic lesion is definitely ischæmic. In the cornu Ammonis the ischæmia is somewhat less absolute, while in the cerebral cortex groups of cells are necrotic, suggesting a partial local asphyxia, which is not so definite as that in the fornix or cornu Ammonis.

The reason for these three varieties of local necrosis is to be found in the difference in the local vascular supply of each area. In the fornix the vessels are terminal; in the cornu Ammonis there is a partial anastomosis; while in the cerebral cortex there is a looped system of vessels providing a rich collateral circulation to any given area. Hence interference with the local vascular supply in the cortex does not result in ischæmia, but in a partial asphyxia, which may be compensated to some extent by the collateral circulation.

EXPERIMENTS.

In this series of experiments (a) Indian ink granules and (b) argyrol were injected into the general circulation of rabbits. The brains were fixed in formalin (10 per cent.) and in formol-ammonium bromide. Serial sections (paraffin) were stained by toluidin blue and iron hæmatoxylin for the demonstration of the nerve-cell changes, and by Cajal's gold sublimate method for the neuroglial reaction.

Rabbit A.

Five c.c. of a 5 per cent. solution of Indian ink were injected into the vein of the ear, and the animal killed seven days afterwards. The brain and spinal cord were fixed in 10 per cent. formol saline.

There was an area of coagulation-necrosis in *each fornix* situated in the lateral curvature, midway between the frontal and the temporal cortex. On the right side the line of demarcation between the normal and the necrotic areas was very sharp, and the necrosed cells showed the characteristic shrinkage of the cell-body

and the homogeneity of the nucleus. On the left side the necrotic cells did not stain quite so intensely as those on the right side, thus indicating an effect of more recent date or of less intensity. In the upper and inner segment of the right fornix a small portion of the cell-layer showed such an increased affinity for the stain as to point to a certain degree of interference with its nutrition. The necrotic change affected the cells in the inferior portion of the fornix and the uncus of the temporal lobe.

In the cornu Ammonis no change was demonstrable in the granular layer, but in the pyramidal layer there were portions in which the cells stained more deeply than normal, both cell-body and protoplasmic processes showing an increased affinity for the dye.

RABBIT B.

Injection into vein of ear of 5 c.c. of a 5 per cent. solution of Indian ink. The rabbit died one and a quarter hours after the injection. The brain and cord were fixed in 10 per cent. formol saline.

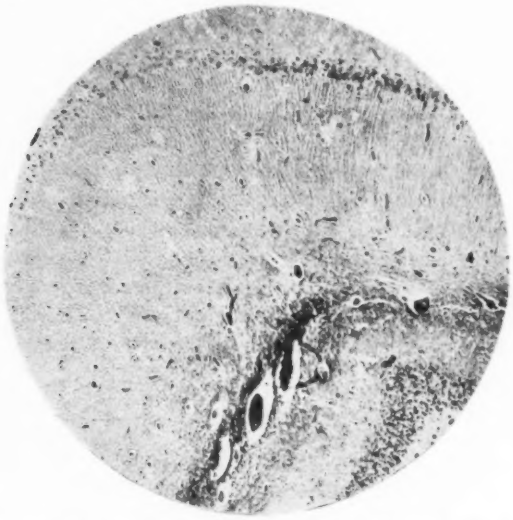

FIG. 1.—At the upper margin of the figure the fornix cells are necrotic; in the white matter immediately below, there are scattered areas of œdema: the lower margin shows the lamina involuta, inferior to which lie the darkly stained necrotic cells of the granular layer of the cornu Ammonis. The vessels of the lamina involuta are filled with granules.

On the left side of the brain the entire fornix was necrotic, with the exception of a small segment adjacent to the superior cortex.

On the right side there was an extensive area of necrosis in the superior portion of the fornix. Immediately inferior to this necrotic area a considerable portion of the fornix layer was quite normal, but lower down where this structure bends towards the temporal lobe there was another necrotic area of considerable

extent. From this point onwards for some little distance the cell-band was quite normal, but at the inferior extremity of the fornix there was another necrotic area continued into the temporal lobe. In these necrotic areas the cells were hyperchromatic and shrunken, there was homogeneous atrophy of the nucleus, and considerable œdema of the tissues in the immediate vicinity.

The bilateral character of the lesions and their multiplicity are worthy of note in this case. The degree of œdema in the cerebral cortex was very slight; it was very evident, however, in the subcortical white matter.

Rabbit C.

Injection into vein of ear of 5 c.c. of a 5 per cent. solution of Indian ink.

The superior portion of the fornix was quite normal, but in the lateral curvature of this structure on each side there was an extensive necrotic area in which the cells were hyperchromatic, shrunken, and stained as a dense homogeneous body in which the nucleus could, in the majority of instances, be barely recognised as a separate structure. The line of demarcation between the necrosed and the normal cells was very sharply defined. The lower portion of

Fig. 2.—Above, the fornix in which the necrotic cells (black) are prominent. Below, the lamina involuta, whose vessels are filled with Indian ink granules. Near the inferior margin note the deeply stained (necrotic) cells of the granular layer of the cornu Ammonis.

the fornix was free from necrotic change, but this was present amongst the cells of the uncus and the adjacent portion of the temporal lobe.

The vessels of the lamina involuta were dilated and there was considerable perivascular œdema. Small œdematous areas were present in both the fornix and the cornu Ammonis, and many cells in the pyramidal layer of the latter had undergone necrosis. The cells of the granular layer stained normally. In the cortex coagulation necrosis affected the pyramidal cells of the deeper layers, and there was present perivascular œdema of medium degree.

RABBIT D.

The left cervical sympathetic chain was divided, and Indian ink granules injected into the general circulation. An area of coagulation-necrosis was found in the lateral portion of each fornix. The cell bodies were hyperchromatic, shrunken, each one surrounded by a small area of œdema, and the nucleus was homogeneous and atrophic. The upper portion of the fornices close to the cortex was also necrosed. On following those necrotic areas through the series of sections towards the posterior aspect of the brain, it was found that their size varied from point to point until they gradually disappeared, thus demonstrating their ischæmic origin. The pyramidal cells of the cornu Ammonis were also necrotic.

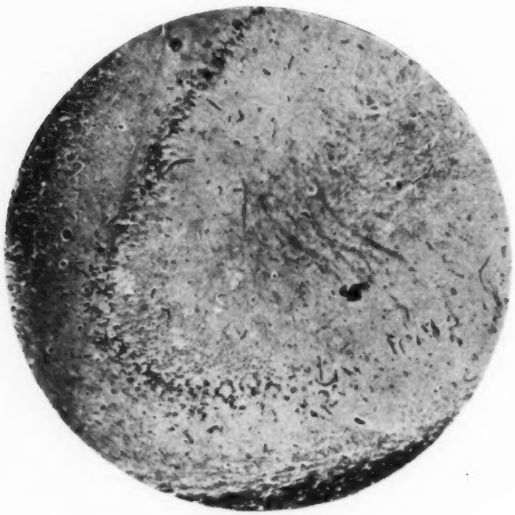

FIG. 3.—Note necrosis of the fornix cells in the upper part of the figure. The necrotic change also affects the pyramidal layer of the cornu Ammonis (lower). The fine capillaries are seen filled with Indian ink granules.

RABBIT E.

The left cervical sympathetic was divided and Indian ink injected into the the general circulation.

There was an area of necrosis at the lateral angle of each fornix. In sections taken posterior to the necrotic area the lesion was found to disappear gradually. The cells of the granular layer of the cornu Ammonis were healthy with a few exceptions, but there was necrosis of the cells in the posterior portion of the pyramidal layer. There were no gross lesions in the cortex. The vessels of the entire brain were filled with granules, viz., in the cortex, choroid plexus, and lamina involuta, as were all the capillaries ramifying amongst the cells the fornix and cornu Ammonis.

RABBIT F.

The left cervical sympathetic was divided and a 1 per cent. solution of argyrol injected into the general circulation.

In the anterior part of the brain there was a large necrotic lesion involving *almost the entire left fornix*, and the nerve-cells in both granular and pyramidal layers of the cornu Ammonis showed the same change. On the right side, at the same level, the fornix was quite normal, but in both granular and pyramidal layers of the cornu Ammonis there was a slight degree of necrosis.

Sections taken at a point more posterior, however, showed definite necrotic change at the *lateral angle of the right fornix* also, with a slight degree of necrosis of both cell-laminæ in the cornu Ammonis. The lesion was therefore bilateral, but involved one fornix much more than the other.

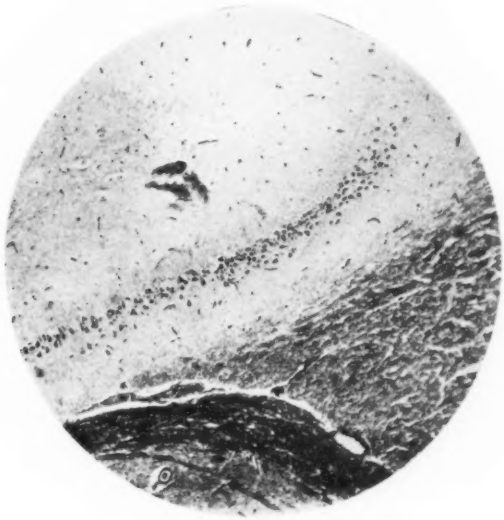

FIG. 4.—Note necrosis of the cells in the pyramidal layer of the cornu Ammonis. Each cell is shrunken and surrounded by a small area of œdema.

RABBIT G.

Intravenous injection of 10 per cent. argyrol. The rabbit died in three hours. Brain and cord fixed in formol saline.

There was a high degree of œdema present in the brain, affecting the cortex but not the subcortical white matter; the white matter superior and inferior to the fornix and the fornix itself. The perivascular spaces of the lamina involuta were widely dilated. There was a well-defined necrotic area in the *lateral curvature of each fornix*, and on the left side there was in addition one smaller in size, situated at some little distance from the mesial surface of the cerebral cortex. The white matter in the immediate vicinity of those necrotic areas was

markedly œdematous. Groups of the cells in the pyramidal layer of the cornu Ammonis were necrotic, but the lesion here was less marked than in the fornix. It is worthy of note that in spite of the highly œdematous condition of the nervous tissues the altered nerve-cells still stained very distinctly and showed the reaction characteristic of coagulation-necrosis to the iron hæmatoxylin stain. Another important point brought out by examining the sections in series was that necrotic foci appeared, and, after a varying number of sections, disappeared, to be replaced by others, thus showing that they were multiple.

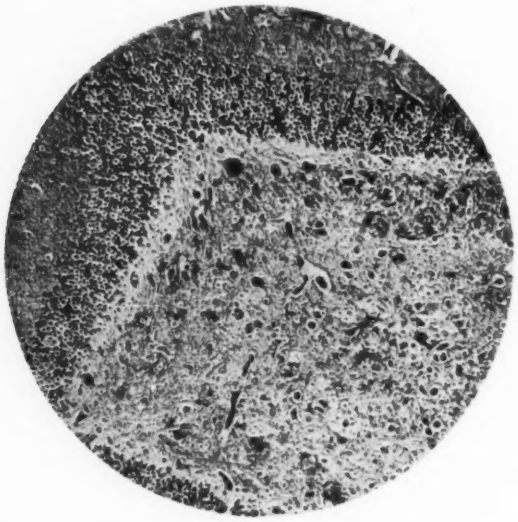

FIG. 5.—At the upper and left margins of the figure many deeply-stained necrotic cells are seen in the granular layer of the cornu Ammonis. Immediately inferior to this is a broad clear band of œdema; there is also generalised perivascular œdema.

RABBIT H.

Intravenous injection of 10 per cent. argyrol.

There was a high degree of œdema around the vessels of the lamina involuta, and in both white and grey matter of the cornu Ammonis, with considerable destruction of the tissue. The white matter generally throughout the brain showed the same change, and the vessels of the choroid plexus were markedly congested, while the plexus itself showed an acute cystic condition. Coagulation necrosis was present in the *fornix of both sides*. There was a very definite necrotic area in the lower portion where it becomes continuous with the temporal lobe, at the lateral portion, and in the pyramidal layer of the cornu Ammonis. In the necrotic areas the nerve-cell body was swollen and hyperchromatic. The nucleus was stained very deeply and homogeneously, and the tissue in the immediate neighbourhood of the necrotic cells was intensely œdematous.

SUMMARY OF EXPERIMENTS.

RABBIT A.—*Indian Ink.* Coagulation necrosis of each fornix at the lateral curvature: also a small necrotic area in the upper and inner segment of the right fornix: early necrosis of the cells in the pyramidal layer of the cornu Ammonis.

RABBIT B.—*Indian Ink.* On the left side almost the entire fornix necrotic: on the right side, three necrotic areas: (a) superior aspect; (b) towards the lower extremity; and (c) in the most inferior portion. Here the necrotic change is continued into the grey matter of the temporal lobe. In the white matter a considerable degree of œdema.

RABBIT C.—*Indian Ink.* Necrosis of the fornix at the lateral curvature on both sides. Granular layer of cornu Ammonis normal: many cells in the pyramidal layer necrotic. Considerable degree of œdema round vessels of lamina involuta, fornix, cornu Ammonis, and in the deeper layers of cortex.

RABBIT D.—*Indian Ink.* Left sympathetic divided: coagulation necrosis at lateral curvature of each fornix: at upper part of fornix near the cortex: pyramidal layer of cornu Ammonis necrotic: œdema round each necrotic cell.

RABBIT E.—*Indian Ink.* Coagulation necrosis at the lateral angle of each fornix: necrosis of pyramidal layer of cornu Ammonis: granular layer normal.

RABBIT F.—*Argyrol 1 per cent.* Left sympathetic divided. Almost entire left fornix necrotic. Necrosis of granular and pyramidal layers of cornu Ammonis: in the right fornix necrosis at lateral angle: necrosis slight in cornu Ammonis. A small degree of œdema round each necrotic cell.

RABBIT G.—*Argyrol 10 per cent.* A high degree of œdema in cortex and lamina involuta: lateral curvature of each fornix necrotic, another (small) necrotic area, on left side, of upper and mesial portion: groups of necrotic cells in the pyramidal layer of cornu Ammonis.

RABBIT H.—*Argyrol 10 per cent.* A high degree of œdema round the vessels of the lamina involuta, and in white and grey matter of cornu Ammonis: subcortical white matter œdematous: coagulation necrosis of both fornices at lateral angle, and inferiorly: pyramidal layer of cornu Ammonis necrotic. In the choroid plexus the vessels were congested, and the plexus itself was cystic.

DISCUSSION.

With regard to the mechanism of production of the lesions, it is evident that they show the characteristic morphology associated with arterial blockage. The nature and site of the lesion are similar whether Indian ink granules or argyrol be employed as the causative agent, and the extent of the damage varies according as the precapillary arterioles or the capillary

branches are obstructed. The size of the necrotic lesion also depends naturally upon the number of vessels involved in the ischæmic process. But while local necrosis is an effect common to injection of granules and to a much more particulate substance such as argyrol, there are also certain differences which seem to be associated with the degree to which the whole of the local vascular mechanism is disturbed. For example, œdema is not such a marked feature after injection of granules as after the injection of argyrol. In the case of the former, the œdema is not great and is purely local, but with the use of argyrol the œdema rises progressively with the increase in strength of the solution, and its effects are seen not only in the fornix and cornu Ammonis, but in the grey cortex and subcortical white matter also.

This gradual rise in the degree and extent of the œdema, which reaches its maximum with the injection of a 10 per cent. solution of argyrol, suggests involvement of the controlling nervous mechanism of the vessels, and that the degree to which this reacts depends upon the strength of the exciting agent. The first effect of the argyrol on the vessels must be one of stimulation, causing contraction and narrowing of the vessel lumen with local ischæmia; this is shown by the necrosis. But with the rise in potency of the exciting agent, or its more prolonged action, paralysis ensues with increased permeability of the vessel wall. Serum now readily escapes from the vessels, and by its pressure destroys the tissues in the neighbourhood of the ischæmic focus, thus extending and intensifying the effect of the necrosis produced by the initial asphyxia.

There are special points of interest to be noted in connexion with the necrotic lesions, viz.:—(1) The lateral aspect of the fornix is a very common situation, and the lesion is often bilateral. (2) The size of the lesion varies from point to point: it may even disappear at one level and reappear at another, being thus multiple. (3) Involvement of the entire fornix is due in all probability to the fusion of several discrete necrotic areas, as if the spastic process at first affected isolated points in the neurovascular mechanism, and then as the vascular spasm spread the necrotic areas became confluent, thus embracing the entire cell-layer.

In the neighbourhood of the damaged areas, the vessels in one of the experiments (argyrol) were observed to be thickened and hyaline, and there was a local reaction of the astrocytes (see fig. 6).

The lesions found to occur after the injection of Indian ink granules and argyrol are similar to those observed after the injection of organisms[1], and to those seen in certain clinical conditions.

They have been described by von Braunmühl in cases of acute excitement, and in puerperal insanity; and by Spatz and Neubürger in whooping-cough. These authors are of opinion that the lesion is due to

ischæmia, which commences with an angiospasm of the cerebral vessels, followed by paralysis, stasis, and congestion. The result is an asphyxiation of the nerve-cells, while the least injured glia-cells proliferate. Rickers[4], discussing the pathogenesis of epilepsy, adopts a similar view, and points out that in the absence of any local organic cause the lesion must be functional in nature. The first stage in the process is vasomotor constriction and ischæmia, followed by paralysis, dilatation, and stasis. The nerve-cells then undergo the changes characteristic of coagulation-necrosis.

FIG. 6.—Note the acute hyaline thickening of the subcortical capillaries, and the astrocytic reaction. Inferiorly, a portion of the fornix is shewn in which the cells are necrotic, and the adjoining white matter destroyed by acute œdema.

Finally it should be noted that the hyaline thickening of the smaller vessels of the brain following the injection of argyrol is an acute change, and has not been observed after the injection of either organisms or Indian ink.

CONCLUSIONS.

The lesion can be caused by mechanical blockage or neuromuscular spasm. It is always of the same nature, i.e., ischæmic and necrotic: œdema is a constant feature, but varies in degree with the potency of the causative agent. When the œdema is excessive, it is a sign of acute disturbance and,

added to coagulation-necrosis, materially augments the damage to the nerve-cell laminæ. It may even include the adjacent white matter.

The necrosis may be accompanied by local hyaline change in the vessel wall, and by a reaction on the part of the fibrillary neuroglia (see fig. 6).

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Editorial.

A DISCUSSION OF NORMALITY.

CLASSIFICATION of disease is a rational attempt to group relatively characteristic departures from a normal or average condition of bodily functioning. It is a kind of map in which the more common or regular departures are marked like arterial roads in red ink. When we have learned this map we know our way about the pathological province. But in practice our interest is forever seeking out new cases that are not marked on the map. By tracing fine nuances of similarity and discriminating more and more subtle shades of variation we have established a pathological ordnance survey map of so detailed a complexity that only a very few minds can lay claim to a mastery of the whole field. This diagnostic chart is an amazing achievement of organised intellect and with its aid we are able to designate every individual departure from the norm and decide upon its local or constitutional significance. Nevertheless, like every intellectual construction, the entire chart is an abstraction. The ultimate norm which we call the ' state of health ' is an abstraction and each more or less typical departure from that norm is nothing but a concept abstracted from a number of more or less similar individual cases. But the individual case by its very nature can never be just the average case. If a painter were commissioned to make a portrait of the average man he would have to paint a creature without expression or character of any sort, which is impossible. For at bottom, individual and average are eternally opposed.

In medicine the therapeutic problem is always concerned with the individual creature. Hence in the practice of medicine there must always be a relative adjustment of two fundamentally irreconcilable factors, the diagnostic abstraction that is based on the principle of the norm, and the individual case that is rooted

in the principle of individuality. The humanity and modesty of the practitioner come very largely from the fact that he has continually to submit his attitude to this inevitable adjustment. The more we approach the psychological attitude to disease the more we realize the relative impotence of our diagnostic classification to assist us in the problem of individual therapy. We can say that the study of psychopathology is a research into the inappropriate ways of human behaviour. But if we have to deal with a case of hysteria and we demonstrate with painstaking detail the various ways in which the patient is departing from the appropriate manner of 'normal' life, although we may succeed in drawing a picture of tragic ineptitude, we shall not improve our case.

We have to face the truth, then, that the rational process of the mind, which enables us to tell what is wrong with the case in relation to our abstract norm, is unable to provide us with that special insight by which we can see what is essentially right in the particular individual attempt. Naturally, if our therapeutic attitude is oriented solely to the norm, every individual departure from the norm must be regarded as a mistake. But the alternative point of view is not only feasible, but a therapeutic necessity. The operation of evolution is a process of ceaseless individual experimentation. Although we see the effects of evolution in the differentiation of broad types and species, evolution as a working principle is found only in the single creature. Admittedly, the greater number of Nature's tentative individual experiments do not come off, or at best are only relatively successful: but none the less, individual departures from type, especially in the realm of psychopathology, can be regarded as experiments of nature that have at least some individual justification.

The constructive attitude that attempts to see the rightness, or at least the justification, of the individual departure is fundamentally based on feeling, and, because feeling is an atypical individual factor which has no relation to the intellectual concept of disease, it is unfortunately excluded from the province of science. But it surely belongs to the practice of medicine as an art, and therefore needs to be given its due value in our appreciation of therapeutic principles. When, for instance, we try to find a fair psychological orientation to the thorny problem of homosexuality, we cannot afford to exclude the judgement of feeling and merely to classify cases according

to the degree of departure from the heterosexual norm. For, were we to adhere to the latter criterion, we should have to regard the passive or negative homosexual (for whom the sex, age, character, or even cleanliness of the erotic object has practically no significance) as more normal, and hence more valuable, than the positive homosexual whose valuation of the object is often highly differentiated and significant. The negative homosexual type in spite of his complete indifference and irresponsibility with regard to the object must, on account of his bisexual catholicity, be judged as a more normal being than the positive homosexual who frequently achieves a psychological differentiation of high distinction, albeit quite incapable of normal heterosexual requirements.

In practical psychotherapy we are daily encountering cases of this kind where individual feeling runs directly counter to the general, as well as the medical, concept of normality, and it is precisely on these grounds that psychiatric classifications that are based rather upon types of behaviour than upon psychic motivation are felt to be so unsatisfactory.

The main difficulty in making a valid system of classification based upon motives comes from the fact that we apprehend motives largely by means of feeling and intuition, and knowledge gained in this way is exceedingly difficult to communicate. At present we can do little more than state the problem in the hope that a more comprehensive insight into the deeper emotional causes of pathological mental conditions will in the future help us to reconcile the subtler judgements of feeling with the requirements of general clinical classification.

Abstracts.

Neurology.

NEUROPATHOLOGY.

[37] **The histopathology of therapeutic (tertian) malaria.**—Walter L. Bruetsch. *Amer. Jour. Psychiat.*, 1932, xii, 19.

The immediate tissue reaction of the body to the malaria plasmodium consists in a stimulation of the reticulo-endothelial apparatus, leading to a new formation of macrophagic tissue in various organs. Both the specific endothelia of the liver, spleen, lymph nodes, and bone marrow, and the histiocytes of the connective tissue take part in the stimulation. In therapeutic malaria the blood histiocytes are mainly derivatives of the specific endothelium. To a minor degree common capillary endothelium is engaged in the formation of intravascular endothelial phagocytes. This has been established for the endothelium of the capillaries of the brain cortex and for the endothelial cells of the capillary venules of certain connective tissues. The capillary endothelial cells, although they show signs of stimulation, do not become phagocytic while they retain their anatomical position in the vessel wall. Besides involving the histiocytes there is an activation of the undifferentiated embryonic mesenchymal cells. The fibroblast, the mesothelial cell, and the histiocyte are distinct types of cells. While both the fibroblast and the mesothelial cell are also capable of stimulation, they still can be distinguished from the active histiocyte in malaria-infected tissue. In the nervous system the macrophagic response is greatest in the leptomeninges. In the arachnoid the malaria-stimulated histiocyte stands out distinctly from the less active arachnoidal lining cell. In the adventitial sheaths of the vessels of the brain cortex the mesodermal phagocytes are only slightly stimulated. About middle-sized and large cortical vessels a small increase in the number of macrophages has been found. In the perivascular spaces of the large vessels in the white matter, in the corpus striatum, and in the pons, stimulated histiocytes are more numerous. The small mesodermal elements along the capillaries of the brain cortex have not been seen to be activated. The microglia, as a whole, does not take part in the general reaction of the reticulo-endothelial system. Therapeutic malaria produces an activation of the mesodermal tissue in which the stimulation of the histiocytes and the activation of the undifferentiated mesenchymal cells are outstanding features. C. S. R.

[38] **The spirochaete in the nervous system and the inflammatory process in the brains of paretics** (Dei rapporti delle spirochete con gli elementi del tessuto nervoso e del processo inflammatorio nei cervelli di paralitici progressivi).—A. MARI. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 597.

FROM the author's experiments he is able to affirm that the ordinary situation of the spirochæte is extracellular. This applies not only to the neurones themselves but also to the neuroglia and to the cells which constitute the inflammatory infiltrate.

R. G. G.

[39] **The Argyll Robertson sign and the pupillary fibres of the optic nerve** (Segno di Argyll Robertson e fibre pupillari del nervo ottico).—C. RIZZO. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 916.

THE author has tested the hypothesis of Tieri which maintains that the Argyll Robertson sign is due to a primary progressive degeneration of a syphilitic nature of the pupillary fibres in the optic nerve that represent the centripetal path of the photomotor reflex. The present researches do not confirm this view.

R. G. G.

[40] **The etiology of disseminated sclerosis** (L'etiologia della sclerosi in placche: stato attuale delle ricerche compiute sulla considetta spherula insularis).—V. TRONCONI. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 551.

THE author reviews the researches on this subject and comes to the conclusion that the spherula insularis cannot be considered as the specific agent in the causation of disseminated sclerosis.

R. G. G.

SENSORIMOTOR NEUROLOGY.

[41] **Epilepsy and congenital syphilis.**—K. A. MENNINGER and W. C. MENNINGER. *Jour. Nerv. Ment. Dis.*, 1932, lxxv, 473.

THE literature on the relationship of congenital syphilis and epilepsy contains many opinions and statistical studies. The consensus favours the view that congenital syphilis may be a direct or an indirect cause of the epileptic syndrome; some authors regard their occurrence together as merely coincidental.

The authors feel that much of the published work on this problem is based upon inadequate diagnostic data. Sometimes a single fixed criterion of syphilis is selected, such as the serum Wassermann test or the therapeutic test (in spite of the well-known fallibility of both); sometimes variable tests are used in various cases without uniformity, sometimes the data upon which the diagnosis is based are not stated. Too frequently no case-histories are cited.

The crux of the problem is the definite diagnosis or exclusion of congenital syphilis. This the authors do not believe can be done upon the basis of the presence or absence of any single symptom or sign or of several fixed and invariable symptoms and signs (including convulsions), but only upon the presence or absence of findings in the carefully investigated hereditary, physical, and chemical constituents of the individual which, taken in association, point to such a diagnosis. Using such a standard, there have been selected for presentation thirty-one cases of individuals having convulsions of the ' idiopathic epilepsy ' type which were regarded as being of congenital syphilitic etiology.

It was concluded that congenital syphilis can produce convulsions, directly and indirectly, without the presence of gross brain lesions or encephalitis (juvenile paresis), and thus that they appear to be ' idiopathic ' epilepsy.

From a statistical viewpoint, when compared with the total number of total epileptics and the total number of congenital syphilitics, the occurrence of congenital epilepsy must be regarded as usual. The frequency, however, is not so important as the definite establishment of its occurrence.

R. G. G.

[42] **The extrapyramidal system and manifestations of hyperkinesis** (Sistema extra-piramidale e manifestazioni ipercinetiche).—Paolo Ottonello. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 385.

Three cases of the syndrome of athetosis are here used for the purpose of determining, on a basis of the study of focal lesions, the importance of the striate body in the genesis of hyperkinesis.

The author maintains that the general examination of the problem suggests arguments in favour of the theory advanced principally by Wilson, which lays down that involuntary movements result from disturbances in cerebral equilibrium by the suppression of stimuli which regulate movements. In the cerebello-mesencephalo-cortical system, the author includes the corpus striatum, the centre for the elaboration of accessory stimuli in the regulation of movements. Thus a lesion strictly confined to this structure can result in hyperkinesis owing to the disturbance from which the cerebello-cerebral system suffers. The inconstancy of a hyperkinetic syndrome can be explained

by variation in intensity of this disturbance, perhaps in relation to the intrinsic character of the special lesion, which cannot always be precisely determined from the causal factors. The corpus striatum however, according to the author, is concerned also in hyperkinesis resulting from lesions in other parts which are included in the cerebello-cerebral system and can have an indirect influence on the symptoms. In such cases there may be athetosis or chorea, with either hypertonia or hypotonia in the muscles.

R. G. G.

[13] **Torsion spasm** (Sullo spasmo di torsione).—F. CARDONA. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 572.

A CLINICAL and pathological description of a case of torsion spasm in which, apart from classical signs, long and violent contractions of the eyes were present, and, in addition, extrapyramidal hypertonia was more manifest on the right side. Lesions were found in the nerve-cells of the whole cerebral cortex especially in the frontal and parietal regions; on the other hand, lesions were not marked in the basal nuclei, the most affected part being the putamen and caudate nucleus.

The author refers his case to torsion spasm both on account of the clinical and pathological characteristics, and the lack of hepatic lesions.

R. G. G.

[14] **Cerebral cysticercus and modifications of the cerebrospinal fluid** (Cisticercosi cerebrale e modificazioni del liquido cefalorachidiano). —C. RIZZO. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 609.

A CASE is described of a woman 54 years old who for the last ten years had suffered from periodic attacks of vomiting. In the last two years the vomiting had occurred in paroxysmal crises and was accompanied by severe headache. The crises of vomiting and headache alternated with period of reasonably good health. For the last year the physical and psychical condition of the patient progressively deteriorated and latterly she could no longer rise to her feet and presented a definite mental enfeeblement. The diagnosis of cerebral cysticercus was made exclusively on the presence of eosinophils in the cerebrospinal fluid.

R. G. G.

[45] **Epithelioma in the squamous cells of the hypophysis** (Gli epiteliomi a cellule piatte dell'ipofisi).—G. Patrassi. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 483.

A review of the literature and of a case of Erdheim's tumour. One hundred and eighteen cases are analyzed and it is found that there is a slight predominance of males over females. It does not seem that Erdheim was right in suggesting that this tumour was mostly found during infancy. On the contrary, higher percentage figures are found in the second, third, fourth and fifth decades of life. It would therefore seem to commence at a time of maturity and of active sexual life. The author suggests that there is a relationship between the development of the tumour and the maximum of endocrine activity, and that there is an anatomical similarity with the cells of the anterior lobe of the pituitary. Considerable detail is given as to the microscopic and macroscopic appearances of the tumour.

R. G. G.

[46] **Rhizomelic spondylosis** (La spondilosi rizomelica).—E. Benassi and E. Rizzatti. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 1.

Spondylosis with ankylosis of the ligaments, which comprises the typically rhizomelitic forms of Strümpell-Marie and those limited to the vertebral column (such as that described by Bechterew) represents a distinct morbid entity clearly distinguishable from all other syndromes involving ankylosis of the spine, but it cannot be divided into pathologically differentiated subdivisions on the sole basis of the participation or freedom from the ankylosing process of certain of the vertebral articulations.

The disease is characterized by total or incomplete ankylosis of part or all of the spinal ligaments and also very often of the articulations of the limb girdles. At the same time there is a diffuse atrophy of bones with some exostosis from periosteal reaction, specially in the pelvis. Almost always bony ankylosis is found between the small vertebral articulations and the sacro-iliac synchondrosis.

Many factors must be taken into account in the etiology, but the rheumatic diathesis is important; neurotrophic influences may also play a part. The fact that the disease affects the male sex almost exclusively suggests an endocrinological factor. This is a long article and gives a complete review of the whole subject with an extensive bibliography.

R. G. G.

PROGNOSIS AND TREATMENT.

[47] **The treatment of tetanus with serum and somnifen** (Siero-somnifenterapia del tetano).—A. LEANZA. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 714.

A COMPARISON of two cases of tetanus treated with intraspinal serum combined with injections of somnifen, and one case treated with serum in the same way combined with sulphate of magnesia. The author considers that the first method is superior to the second and gives his theoretical and practical reasons for thinking this the best method for the treatment of tetanus.

R. G. G.

Psychopathology.

PSYCHOLOGY.

[48] **Libidinal types.**—SIGM. FREUD. *Psychoanalytic Quarterly*, 1932, i, 3.

THREE main libidinal types, each according to the predominance of the investment of libido, are distinguished—the erotic, the narcissistic, and the compulsive. Erotic persons are mastered by the fear of losing love, and are therefore especially dependent on others who have love to deny them. Even in its pure form this type is quite frequent.

The compulsive is distinguished by the predominance of the super-ego which is differentiated from the ego under high tension. This type is mastered by the fear of conscience instead of by the fear of losing love; is, so to speak, inwardly rather than outwardly dependent; displays a high degree of self-reliance, and becomes the actual, for the most part, conservative pillar of civilization. The third type, the narcissistic, is essentially negatively characterized. There is no tension between the ego and the super-ego. There is no predominance of erotic needs. The chief interest is directed towards self-maintenance. Such persons are independent and little intimidated. A large amount of aggression which, moreover, is expressed in readiness for activity, is available to the ego. Loving is preferred to being loved. People of this type impress others as 'personalities' and are peculiarly fitted to serve as support for others, to assume the rôle of leadership, to add new stimulus to cultural development, or to attack the existing order. Mixtures of these types may occur. It is perhaps to the erotic-narcissistic type that we must concede the greatest frequency.

C. S. R.

[49] **Concerning emotion as impulsion and instinct as orientation.**—J. C. WHITEHORN. *Amer. Jour. Psychiat.*, 1932, xi, 1093.

HERE instincts are considered as action patterns, oriented to fill biological needs; the most fundamental determinants of directed conduct, but not sources of energy. These action patterns are not assumed to be completely stereotyped or immutable, but their modification is attributed to intelligence rather than to some power latent within the instinctive disposition itself. Emotion is here conceived not as a psychic parallel or epiphenomenon of instinct, but as complementary or reciprocal thereto. Real biological significance is here attributed to the impulsion experience as the basis of emotion, the interrupter of inadequate attitudes. The provisional nature of these concepts is emphasized. When it is said that impulsion arouses to action, instinct orients activity towards objects and intelligence modifies and integrates activity, it is not to be understood in any metaphysical sense, that impulsion, instinct, and intelligence are distinct and separable entities, acting upon each other or upon the organism. They are merely concepts, abstracted from the real unity of experience for convenience of thought and discussion. These concepts represent a tentative concession, as it were, to the objectifying tendency of the mind, which is prerequisite to logical thought and verifiable inference.

C. S. R.

[50] **The perceptions of children and the psychology of form** (Les perceptions des enfants et la psychologie de la gestalt).—RICHARD MEILI. *Arch. de psychol.*, 1931, xxiii, 41.

CHILDREN are unable to realize complicated structures. Their view of an ensemble is simple and more primitive. This is because the child is more subject to optical illusions as regards size and localization. Children have as strong a realization of symmetry and good form as have adults, but as regards topography objective conditions give way to the subjective and sometimes therefore a child sees good form where an adult does not. The child sees objects in a syncretic manner. In structures with strong unity the child will appreciate the parts, but where the internal parts are vivid it will destroy the unity to the child. The differences are attributed to difference in neural structure.

E. M.

[51] **Sexual initiation** (L'initiation sexuelle).—N. CARNIVET. *Arch. de psychol.*, 1931, xxiii, 276.

THE relationship between the mother and child can be profoundly disturbed when the child discovers that the parents have lied. Confidence is immediately withdrawn. There is a lowering of the parental ideal, a feeling of uneasiness and reproach. In no field of mental development are those disturbances more likely to take place than the field of sexual initiation, and it is the parents' duty to tell the truth on the earliest occasion.

E. M.

[52] **The notion of temperament** (Notion de temperament). R. ALLENDY. *L'hygiène ment.*, 1931, xxvi, 139.

THE recent work of Kretschmer on the relationship between physique and character is correlated with the concept of anabolic and metabolic types, and this latter was to define temperament in terms of its organic background. The author feels that he has correlated organic endowment with the psyche. Psychological plasticity, or its absence, as portrayed in Bleuler's schizoid and syntonic types, can be viewed in the light of Janet's theory of psychological tension. It is obvious that the author envisages the metabolic substratum for differences in character.

E. M.

[53] **A psycho-physiological explanation of the so-called human 'aura.'**—D. F. FRASER-HARRIS. *Brit. Jour. Med. Psychol.*, 1932, xii, 174.

THE appearances referred to by occultists as 'aura' and supposed by them to be emanations of a substance of para-normal nature seem capable of being accounted for on the principle either of spatial or temporal retino-cerebral induction. The writer's experimental observations lead to the conclusion that auras have no objective, external, independent existence, but are essentially the results in consciousness of those states of the retina known as negative after-images.

On this view, the aura is neither an illusion nor a hallucination, but rather a subjective sensation or unshared perception corresponding not to the presence of an external object but to a more or less transitory physiological condition of the retina of the percipient.

C. S. R.

NEUROSES AND PSYCHONEUROSES.

[51] **Occlusal neuroses : the application of psychotherapy to dental problems.** —Bertrand S. Frohman. *Psychoanalytic Review*, 1932, xix, 297.

Three patients are analytically discussed. They had become tooth-conscious, and were thrown over into a tooth-neurosis, which is described as an occlusal neurosis. The simple procedure of permitting the patients to talk themselves out of their grief certainly can be considered as a specific antidote for having talked themselves or having someone else talk them into it. If it is purely a habit, with no neurotic background, then it is a bad habit, which should be corrected. In every walk of life the frequency of this symptom is noted—many people grind their teeth. One need but observe the constant motion of the jaws to arrive at the same conclusion. If this is so, then the writer thinks that it is not too radical to state that a high percentage of all human beings are producing pyorrhœa mechanically, and this, he believes, is the important factor in the etiology of a serious problem confronting the dental profession to-day.

C. S. R.

[55] **The psychological factor in migraine.**—Hilda Weber. *Brit. Jour. Med. Psychol.*, 1932, xii, 151.

The psychological factor is said to play a rôle of considerable importance in the etiology of at least some cases of migraine, acting upon a somatic tendency to this type of malfunction. The problem that still awaits solution is the determination of the relative importance of the part played by these two factors. While symptomatic treatment has a place, to attain more lasting results a more definitely causal treatment is required. The information gained from the detailed study of a case which has been brought to a satisfactory conclusion may have a bearing upon the prophylaxis and treatment of other cases, always provided that the attitude of mind so induced does not lead to a stereotyped way of thinking. The case considered in this paper shows that a psychological factor played an essential rôle in causation. The mental mechanisms operative were found to be related to a primitive mode of reaction, which is to be observed in all persons at a certain level of development. This suggests that a similar mechanism may be at work in other cases of migraine. The variation which takes place in the course of development renders it possible that apparently unlike reactions, when examined more closely, may be found to rest upon a like nucleus.

C. S. R.

[56] **Auditory hallucinations in non-psychotic children.**—Max Levin. *Amer. Jour. Psychiat.*, 1932, xi, 1119.

Four cases of boys who were non-psychotic and had true auditory hallucinations are presented. Two of them showed what probably are early symptoms of a schizophrenic reaction. The other two, while maladjusted, showed nothing suggestive of schizophrenia or any other psychosis. All four boys were below the average in intelligence, two of them conspicuously so. The hallucinatory episodes are studied with regard to the quality of the hallucinatory perception, the localization, the presence of accessory sensations, the content, and the apparent functions that are involved. The hallucinations seem to have participated in the fulfilment of the functions of: (a) defence; (b) enhancement of self-esteem; (c) satisfaction of instinctive cravings and of a desire for pleasure; (d) repression of unwelcome instinctive cravings; (e) self-punishment, in expiation of a sense of guilt. It is emphasized that while certain functions are fulfilled, these probably constitute only one link in the chain of factors which really causes the hallucinations to occur. In one case there was evidence of mixed deafness in one ear and in another there was the possibility of some organic auditory disturbance. The significance of the findings for the general problem of projection and their relationship to recent work on eidetics are discussed.

C. S. R.

PSYCHOSES.

[57] **A contribution to the problem of heredity among schizophrenics.**—M. Bleuler. *Jour. Nerv. Ment. Dis.*, 1931, lxxiv, 393.

A long paper describing the investigations carried out from which several important conclusions were drawn.

The frequency of mental diseases and of mental eccentricities in the families of schizophrenic patients was investigated in American material. A far-reaching agreement was discovered between the findings in New York and the findings of Ruedin, Luxenburger, Hoffmann and others in Munich. The differences between New York and Munich are less than those between Munich and Basle. To be exact, the expectation of schizophrenia among siblings of schizophrenics was found to be 4·8 per cent.

Since the biological unity of the group of schizophrenias is not probable, an investigation was made to determine whether familial influences are of equal importance in different forms of schizophrenia. The following generalizations were arrived at from the material, only as conjectures and without the confirmation of larger figures.

Among the schizophrenics without hereditary strain one group of patients stands out in striking fashion. They may be distinguished clinically from the majority of the schizophrenics with hereditary strain in the following ways: they are patients with severe dementia but are capable of a certain affective rapport such as idiots have, and their bearing and expression are apathetic. Their illness began early, ran a quick progressive course and showed no substantial remissions. Physically they are obese dysplastics and before the psychosis they were not plainly schizoid but rather of good-natured bearing.

When the author selected those families in which the formal pictures of the psychoses of two related members were very similar to each other, he came upon cases which are related, symptomatologically, to the manic-depressive constellation. It is not permissible from his material to assume a tendency to dementia from an appearance of it within the family, for two cases ending in dementia rarely occur in the same family. His cases with schizophrenic strain run a course which, on the average, is somewhat lighter and in no case severer than those which have no schizophrenic strain. In the face of common contradictory experience, it is necessary to consider the effect of selection.

It was observed that the schizoid individual and the schizophrenic occur among the children of parents who are not schizoid. While the majority of the eccentrics among the relatives of these schizophrenics were typical schizoids, the frequency of moral defectives was striking also. Furthermore, the author found persons in whom the schizoid state was apparent during only a certain period of their lives. For example, cases were observed which exhibited mild, uncharacterized disturbances in involution and which left behind a permanent character change without exhibiting specific schizoid traits. He also found cases of alternating personality among the relatives.

R. G. G.

[58] **Analysis and structure of a transient hypomania.**—Bertram D. Lewin. *Psychoanalytic Quarterly*, 1932, i, 43.

The personality structure of a case which is spoken of as hypomania is thus summarized. The ego fused with the super-ego by an oral mechanism; the resultant ' hypomanic ego ' was a purified pleasure-ego, ingesting the sources of pleasure, ejecting the sources of pain by denying. The new ego contained the parental identifications previously in the super-ego. These identifications were sexualized, and the sadism previously emanating from the super-ego, but now in the ego, was turned against the environment, partly in sublimations, partly in denials of parts of reality or the intrapsychic representatives of reality which might cause pain.

C. S. R.

[59] **The significance of histological alterations in the small intestine and in the liver in the syndrome of confusional insanity** (Sul significato delle alterazioni istologiche dell'intestino tenue e del fegato nelie sindromi amenziali).—U. DE GIACOMO. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 633.

THE author examined the liver and the small intestine in seven cases of confusional insanity. The histological lesions constantly met with correspond more to an irritative process of a toxic nature than to an inflammatory process of an infective origin. The author reviews the character of these lesions and concludes that they illuminate the pathogenic concepts of Buscaino on the pathogenesis of the essential and symptomatic forms of confusional insanity.

R. G. G.

PSYCHOPATHOLOGY.

[60] **The psychogalvanic reactivity in affective disorders.**—ÖRNULV ÖDEGAARD. *Brit. Jour. Med. Psychol.*, 1932, xii, 132.

THE psychogalvanic reflex has mostly been used as an amplification of the association experiment to determine the emotional attitude to special stimuli, stressing reaction time and amplitude. If the curve is regarded as a whole, however, it can be taken as a sample of the vegetative-emotional reactivity in general under the standard conditions of the experiment. A classification of the curves according to their general appearance is therefore proposed, based on the shape of the reactions and their way of succeeding each other. Psychogalvanic reactivity is regarded as an interaction of two components: one (called negative) due to increased potential of the palm, another (called positive) due to increased potential of the back of the hand, and causing a deflection of the needle in the opposite direction. From the shape of the reactions the share of each component can be determined. Curves from patients differ from normals in three respects. The reactivity may be decreased, it may be unstable, or the positive component shows more decrease than the negative one. These three pathological traits can be expressed quantitatively, and therefore be used for comparison of the reactivity in different groups of patients. Most disturbance is found in manic, schizophrenic and organic psychoses, least in hysteria. In organic cases (and less markedly in depressions) decreased reactivity is the most important pathological factor, in schizophrenia decrease of the positive component. In manic excitement, hysteria and constitutional abnormalities lability is the outstanding feature.

Within the group of depressions (including the more depressive neuroses) the mood has the most decisive influence upon the reactivity: it is far more

disturbed in tense and anxious than in depressed or relatively normal moods. If the anxiety gets its normal outlet in restless behaviour, the outstanding pathological feature will be a great decrease of the positive component. If this restlessness is absent (controlled, suppressed?) the reactivity is on the other hand high and unstable. This indicates that the negative component represents a more instinctive, primitive part of the affectivity, less influenced than the positive one by the higher, more cognitive levels.

Lability predominates in younger patients and in cases of short duration, decreased reactivity in older ones and when the duration is longer. Depressions without content show a more normal attitude than the rest. Organic trends give a marked decrease of the reactivity. Clinical improvement is accompanied by a definite return of the psychogalvanic reactivity towards normal.

C. S. R.

[61] **Rorschach's tests** (Les tests de Rorschach).—Marguerite Loosli-Ysteri. *Arch. de psychol.*, 1930, xxii, 104.

The aim of this research was to determine differences, if any, as between types of children from Zurich and from Geneva. Rorschach's tests enable us to diagnose the mental age of children and incidentally to distinguish between extrovert and introvert types. In the absence of a standard of racial endowment it is impossible to make dogmatic statements about racial differences on the psychological plane; but the degree of infantilism can be assessed from achievements in these tests. There was a difference of some significance noted between children living in institutions and those who resided with their families. The latter were more negative in tendencies, timid and depressed. These characteristics are accentuated in the case of neuropathic children. The proportion of various types of child assessed by the Rorschach test is not the same as amongst children living at home. Introverts are in excess, negativism and obstinacy six times more frequent, and they tend to be withdrawn into themselves.

E. M.

[62] **Psychological changes in normal and abnormal individuals under the influence of sodium amytal.**—Eric Lindemann. *Amer. Jour. Psychiat.*, 1932, xi, 1083.

The main conclusion is that sodium amytal produces a marked change in the behaviour of certain types of psychotic patients and a less pronounced change in the emotional attitude of normal individuals, on the basis of the release of inhibitions. It allows the study of the thought-content of stuporose patients, which was previously not possible, and gives material which can be used in psychotherapeutic efforts.

C. S. R.

[63] **Kretschmer's types** (Sur les types de Kretschmer).—SIGURD PETERSEN. *L'hygiène ment.*, 1931, xxvi, 121.

IT is suggested that the Kretschmer types of physique—(1) the narrow-skulled leptosome type, (2) the athletic type, (3) the dysplastic types (eunuchoid, polyglandular, and the hypoplastic infantile), (4) the pyknic type—form a substratum from which the various psychiatric reaction types spring. This method of study is useful in determining the ingredients in a mixed psychosis and in defining the candidates for future psychosis.

E. M.

[64] **Contribution to the study of the microglia in mental disease** (Contributo allo studio della microglia nei malati di mente).—C. E. ROBERTI. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 461.

IN pure confusional states, that is to say, not superadded in the course of other mental illnesses, the microglia does not seem to react to an appreciable degree, so far as it is possible to judge by the very partial result obtained with the common methods of staining. It has been demonstrated at least in animals that microglia plays a small part in experimental intoxication.

In the schizophrenic syndrome the behaviour of the microglia is maximal; the cells contribute very markedly to the pathological picture of dementia præcox. This is in accordance with the conception that this syndrome is encephalitic in nature.

In a symptomatic confusional syndrome secondary to active morbid processes in the brain the microglia shows the alterations typical of the dominant malady without there being any particular changes directly due to the confusional state.

R. G. G.

[65] **The reaction of Costa in neuropsychiatry** (La reazione di Costa in neuro-psichiatria).—G. CURTI. *Riv. di pat. nerv. e ment.*, 1931, xxxviii, 696.

THIS is a novocain-formalin precipitate reaction with blood which is supposed to demonstrate toxæmia, but the author's experiments lead him to regard the test as non-specific, and he does not think it can be used to prove the toxic origin of dementia præcox.

R. G. G.

Reviews and Notices of Books.

Accidents, Neuroses, and Compensation. By J. H. Huddleson, M.D., Associate in Neurology, Columbia University, New York. With a foreword by Dr. J. Ramsay Hunt, Professor of Neurology, Columbia University. London: Baillière Tindall and Cox. 1932. Pp. 256. Price 21s.

It is good to find collected in a single volume a mass of well-analyzed material, and a carefully compiled record of the experiences of many observers, dealing with the perennial problem of accident, neurosis, and compensation. Dr. Huddleson brings to his task a judicial and unbiassed mind, manifesting a keen insight into human nature and a sound appreciation of the unsatisfactory features of that problem for which the medical profession is in no way responsible. He makes it clear how social custom and public opinion have steadily if perhaps unwittingly encouraged the development of traumatic neuroses by their attitude towards the question of responsibility. Recovery from a neurosis has become the business of the employer, in the sense that the injured party can hope to be indemnified by him. Hence arise incentives for the retention of a neurosis. It is remarkable, and of much significance, that the cause of a given neurosis seems rarely if ever to be sought, or admitted, in the action of an intrinsic factor, but invariably of an extrinsic one. The well-known fact that severe somatic injury strongly predisposes again the development of a neurosis has only one meaning, in the case of the industrial worker—he thereby has already become the possessor of a disability that entails compensation.

Some interesting if rather academic discussion bears on the vexed question of the 'organic-functional' antithesis. Many competent authorities in neurology and psychiatry deny its validity altogether, and with reason. Dr. Huddleson's present view seems to be that in the last analysis structure and function cannot be separated, but that a line should be drawn at some supramolecular level; in other words, it comes in between activities of a molecular and of a molar kind—the latter at present may be taken as structural or organic. If this differentiation can be supposed to correspond to the fact that disorder of function is possible without immediate and enduring alterations in structure that are recognizable by the technique of to-day it may serve.

Another aspect of the whole matter that is well brought out is the as yet perhaps rather ill-appreciated fact that in a traumatic neurosis different difficulties lie at different levels. Hence it comes about that superficial disturbances can scarcely be separated from malingering, or indeed may be indistinguishable therefrom. The two often appear interwoven. The author is probably right in claiming that relief by monetary consideration itself tends to bring deeper maladjustments nearer the surface and therefore they become more amenable.

The book has intrinsic merits which should ensure a wide appreciation by all whose practice brings them into contact with the types of case here examined; it is well written and has a comprehensive bibliography.

Histopathology of the Central Nervous System. By Prof. Dr. L. Bouman, Utrecht, and Prof. Dr. S. T. Bok, Leiden. With 43 plates. Utrecht: A. Oosthoek's Publishing Co. 1932. Price not stated.

This atlas of histopathology of the nervous system contains a brief text in English, introductory to more elaborate treatises, and consists mainly of some 200 microphotographs, untouched and beautifully reproduced, which illustrate the more important nervous diseases and also the general microscopic anatomy of the neural tissues in pathological conditions. They are all particularly clear, and each is selected with a view to exemplifying some special point. Those of encephalitis post vaccinationem are excellent in this respect, as are those of subacute combined degeneration (here termed funicular myelitis). Tumours, syringomyelia, and congenital defects do not come under the purview of the authors, who have classified the affections dealt with as follows: (1) those distinguished by progressive changes in the glia; (2) those with infiltration of vessel walls in addition; (3) those resulting from defective blood circulation; (4) those of an involutional kind.

An atlas such as this enables the student to appreciate at a glance the salient features of neuropathology considered in relation to individual nervous diseases, and its study will undoubtedly facilitate the laborious processes of learning.

Acromegaly. By F. R. B. Atkinson, M.D. With a foreword by Sir Arthur Keith. London: Bale, Sons and Danielsson. 1932. Pp. 260. Price 21s.

It must have been a labour of love that has occupied Dr. Atkinson for 20 years; he seems to have traced every record of acromegaly from the earliest to the latest, his tables of analysis comprising the data of no fewer than 1,319 cases. These tables, and the bibliography, account for some 176 pages of his

monograph, leaving less than 100 to cover historical, clinical, and pathological description. This part of the book is well done, entering as it does into minutiæ with which not a few professional readers may be unfamiliar. The chapter on pathogenesis is comparatively short, but adequate; it sums up the problem more or less on lines advocated by Cushing, though little attention seems to be paid to the interrelation of pituitary overfunction and sympathetic centres of the diencephalon. The real core of the pathogenic mystery consists in ascertaining the cause of the chromophil hyperplasia. Certain recorded 'negative' cases might have been discussed with advantage.

All neurologists should add the volume to their bookshelves, for it covers the ground exhaustively and is completely documented. It is not, however, illustrated.

Experimental Analysis of Development. By BERNHARD DÜRKEN, Professor in the University of Breslau. Translated by H. G. and A. M. NEWTH. With 120 illustrations. London: George Allen and Unwin. 1932. Pp. 288. Price 14s.

EXPERIMENTAL embryology may on first thoughts seem somewhat remote from the fields of neurology and psychopathology; yet workers in both deal with faults of development, nervous or mental, and we are insistently assured that a knowledge of biology is a prerequisite to advance in other branches of scientific study. But few medical men, we may suppose, are aware of recent conclusions derived from modern work in experimental embryology, conclusions dealing mainly with the mechanics of development. These are critically reviewed and annotated in this masterly production, which, highly technical though it is, touches matters of importance to the student of the nervous system at many points. Here will be found evidence summarized in support of the views that, for example, from fertilization arises a new organismal unit or whole, despite its dual origin, and that this fusion is something more than the apposition of two components; that the entire process of development is a function of the germ as a whole, single cells being as it were passively carried along in its current; that the capabilities of various regions of the developing egg are more extensive than their actual performance during embryogenesis. Special interest attaches to the potency of regeneration, areas whose destiny seems fixed and precise being proved capable of a wider functional range. Pluripotent cells appear, through whose agency, under abnormal circumstances, one kind of tissue may be transformed into another—so-called metaplasia. The data of heteromorphosis are also examined; they show convincingly that by regeneration an organ of a different kind than that which has been lost or removed may come into being. These considerations, and others also discussed, lead to the conclusion that

pre-formation does not occur, and Professor Dürken takes a firm stand in opposition to current opinions of chromosome and gene function, which attribute the structures of the adult to actual preformed germinal rudiments. On the contrary, he opposes Weismannian hypotheses by affirming the indeterminateness of germinal development and the indefiniteness of its fate. Evidence is adduced which indicates that the real purpose of development is not the production of parts but the differentiation of a whole. It depends upon the whole germ always, and is in ultimate analysis a process of integration.

Perhaps the chief value of the book (aside from its technical importance) resides in its stimulating suggestiveness to minds not perhaps familiar with its data but aware of their applicability to developmental problems of another order.

Die Nervenkrankheiten des Kindesalters. By Prof. Dr. GEORG PERITZ, Berlin. Second revised and enlarged edition. With 178 illustrations. Leipzig: Fischers Medizinische Buchhandlung. 1932. Pp. 688. Price M. 39.50.

THE first edition of this textbook of nervous diseases in children appeared some 20 years ago; this edition is for practical purposes a new book. It ranges widely and not too discursively over the field, and in many respects is modern in conception and outlook. On the other hand, its descriptions are in some ways curiously unequal, for while spasmophilia (socalled) is treated at almost inordinate length, the article on meningitis refers to little more than tuberculous, purulent, and epidemic cerebrospinal varieties. The chapter on cerebral tumour will not perhaps appeal to the modernist since its pathological classification leaves much to be desired, terms that are now familiar being not so much as mentioned. The allusions to Schilder's encephalitis, which sometimes occurs in youthful subjects, and to other comparative rarities, are helpful so far as they go. The scope of the work includes disorders of the ductless glands, also the neuroses and psychoses of children and is therefore comprehensive. The book is well illustrated and clearly printed, but for one of its size references to the literature are rather scanty.

The Science of Signs and Symptoms. By R. J. S. MCDOWALL, D.Sc., M.B., Professor of Physiology, King's College, London. London: W. Heinemann. 1932. Pp. 440. Price 21s.

THIS is a delightfully written book. Its theme is the application of physiology to clinical medicine—not a dry-as-dust physiology remote from clinical reality but one that is alive with notions and practicabilities of interesting kinds.

That its author occupies a distinguished position among the physiological fraternity ensures the accuracy and modernity of his conceptions; but the charm of the work resides in the ease with which he simplifies recondite topics and the skill with which he grasps their essence and turns his knowledge to the advantage of the scientifically-minded clinician. The book ranges over a wide field, and contains much that directly concerns the neurologist and, indeed, the psychopathologist. Professor McDowall condemns the attitude of the ' new psychologist ' who ignores all anatomical and physiological data in prosecuting his subject, pointing out that psychological procedures are often based on physiological principles. An ingenious illustration of this is supplied; he believes in the possibility of ' conditioned pain,' i.e. in the formation of ' sensory reflexes ' comparable to the conditioned motor reflex, and argues plausibly that the ' cures' effected by Christian scientists, osteopaths, chiropractors and others of the class often consist in nothing else than the alteration of conditioned reflexes of the sensory and not motor series.

The volume is one which we cordially recommend to the attention of all interested in scientific medicine.

An Introduction to Analytical Psychotherapy. By T. A. Ross, M.D., etc., Medical Director of the Cassel Hospital for Functional Nervous Disorders. London: Edward Arnold. 1932. Pp. 203. Price 10s. 6d.

Dr. T. A. Ross deals, out of a rich experience, with the application of psychoanalytic principles to the everyday clinical problems of the psychoneurotic. Avowing himself no disciple of any one psychoanalytic school, yet admitting with candour the indebtedness of all present-day psychotherapists to the genius of Freud, he writes in a pleasantly readable and lucid fashion of the unconscious mind and what is connoted thereby, of transference, sex difficulties, dreams, symptom-formation, and kindred topics. His style is distinguished by apt illustration and his interpretation of clinical phenomena by sound and independent common sense. One chapter is devoted to analysis of a special case, but otherwise he draws on many personal experiences as a psychotherapist for the material to bring his arguments home. Dr. Ross makes no effort to defend the excesses of ' wild psychoanalysts ' who sacrifice reasonableness of mind (and shall we say humour?) at the altar of Freudian devotion, and for this not a few will thank him. On the contrary, he is justly critical of such errors of commission; he argues, for example, against the immutability of symbols; he does not fail to emphasize on this or that occasion how little of the symptoms has sexual significance; and, notably, he is persuaded that evasion of conflict in the conscious mind may prove mischievous from the standpoint of neurosis development.

A last chapter is concerned with technique and training. He stresses the importance of good medical knowledge, naturally, yet declares that the psychoneuroses are no more connected with neurology than with any other branch of medicine. As Dr. Ross does not define what he understands by neurology, his allegation loses point; curiously enough he allows the resemblance between hysteria and schizophrenia in varied types and circumstances, hence a training in psychiatry is admitted to have its value. But no professing student of the nervous system in its full and only real meaning will consent to the insinuation that neuroses are not nervous, or belie his daily experience by granting that phenomena of a psychoneurotic kind seldom appear in connexion with ' organic ' nervous disease, or as seldom have to be distinguished therefrom.

Études cliniques sur la reaction myodystonique. By E. MELKERSSON. Acta Medica Scandinavica, Supplementum XLIV. Göteberg: Wald. Zachrissons Boktryckeri. 1932. Pp. 285.

THE myodystonic reaction, described originally by Söderbergh, has features differentiating it slightly from the myotonic reaction. After tonic contraction on electrical stimulation, and continuing contraction for an appreciable time when excitation ceases, the muscle relaxes, and as it does so it exhibits one or two, or more, momentary recontractions, as it were, which involve the whole muscle. In a second form these brief, clonic, spontaneous recontractions occur though relaxation is not obviously retarded. To the study of this variety of the myotonic reaction the author devotes a monograph of nearly 300 pages. He has observed it in Parkinsonism, Wilson's disease, pseudosclerosis, various extrapyramidal syndromes, spasmodic torticollis, dystrophia myotonica, amyotrophic lateral sclerosis, syringomyelia, myxœdema. The question of its significance and localization is discussed at some length; the view is taken that the reaction may be either myogenic or neurogenic but that the evidence undoubtedly favours the latter theory. The post- or re-contractions argue strongly against a myogenic hypothesis.

Inanition und Epilepsie. By CARL CLEMMESEN. Acta Psychiatrica et Neurologica, Supplementum III. Copenhagen: Levin and Munksgaard. 1932. Pp. 164.

THE starvation treatment of epilepsy has been studied in great detail by Dr. Clemmesen, on the basis of no fewer than 155 cases. His monograph is replete with information of a biochemical and clinical kind, collected in tables and analyzed with care. From the therapeutic standpoint his conclusion is to the effect that the method will in the course of four or five days cause attacks to cease, and that the certainty of the procedure is uninfluenced by the

duration of the epilepsy. Its effect is equally sure whether the fits are organic or cryptogenic—an illuminating commentary on the theories of those who make of ' genuine ' epilepsy an exclusive category. Starvation works best in those patients who suffer from frequent attacks. From the viewpoint of pathogenesis the author concludes that the beneficent working of the technique is due to the dehydration which it induces.

Klinische und vererbungsmedizinische Untersuchungen über Oligophrenie. By TORSTEN SJÖGREN. Acta Psychiatrica et Neurologica, Supplementum II. Copenhagen: Levin and Munksgaard. 1932. Pp. 121.

THIS monograph supplies full information in respect of the occurrence, in northern Sweden, of 52 cases of oligophrenia among some 34 peasant families, where intermarrying and inbreeding existed to some extent. The subjects were of low mental attainment, unable to read, write, or count. Their level was approximately that of a normal child between three and six years. Dysarthria was often found, agrammatism also; and a slow, unsteady gait. The patients were of pithecoid type somatically. The fundi were normal; epilepsy seldom occurred. Brain-puncture (in five cases) showed no abnormality of architectonics in the frontal lobe—the method, however, is of negligible value.

This variety of oligophrenia seems definitely to be of the form of a Mendelian recessive and probably monohybrid.

Adolescent Girlhood. By MARY CHADWICK. London: George Allen and Unwin. 1932. Pp. 303. Price 10s. 6d.

THE authoress of this readable book discusses simply yet shrewdly the problems incidental to the period of growing up, so far as they concern the female sex. Her insight into the mind of girlhood is sympathetic, and her knowledge of the various aspects of these problems is rich and sure. Whether unwittingly or not, the writer seems to have a tendency to overstress and underline the extent and degree of these knotty questions; the reader notes how little is said of the normal girl and the normal way in which she meets new situations. This tendency to deepen the shadows is to be deprecated, as it may give rise to wrong impressions. Indeed, the authoress (almost at the close of her book) admits that ' *every* girl does not suffer from *all* the troubles which are described '; yet this is somewhat qualified by the statement that ' her adolescence is the happier for being uneventful, if it be true that it can ever be.' Were this to be taken literally then there would be an

end of normality. Of course, the purpose is to draw attention to such 'troubles,' otherwise the book becomes pointless. The wise assistance which is offered in a friendly spirit within these pages might well be supplemented by the paying of more attention to self-help.

The Defeat of Baudelaire. By RÉNÉ LAFORGUE. International Psychoanalytical Library, edited by ERNEST JONES, M.D. No. 21. Translated from the French by HERBERT AGAR. London: Hogarth Press. 1932. Pp. 192. Price 10s. 6d.

DR. LAFORGUE has written a psychoanalytic study of the neurosis of the French poet Baudelaire. Its theme is that the neurosis does not belong to any socalled classical type but is distinguished by a series of reactions of an asocial kind—the 'need' to shock, to lie, to steal, to be punished, etc. Behind such manifestations is asserted to lurk a masochistic background, and this way of looking at Baudelaire's numerous 'symptoms' is given support by details culled from various sources. The poet was also an alcoholic, drug addict, and neurosyphilitic. It is interesting, as illustrating the standpoint of the author, that the cerebral syphilis from which he died is here alleged to have been the consequence of his neurosis.

Character and Personality. An International Quarterly for Psychodiagnostics and Allied Studies. Edited by ROBERT SAUDEK. Vol. I, No. 1. London: George Allen and Unwin. 1932. Subscription price 7s. 6d. per annum; single copies 2s.

THE first number of a new quarterly intended to concern itself with human conduct and its laws, with the diagnosis of human behaviour individually or in groups, contains a variety of interesting articles, among which that by C. G. Jung on 'Sigmund Freud in his Historical Setting' will undoubtedly engage most attention. Dr. Jung's reasoned contribution, couched in temporate language, conceives of Freud as a creature of his time, an exponent of the *ressentiment* of the twentieth against the nineteenth century; he can be understood best as a great destroyer, breaking the chains of the past. His theory 'does not stand for a new way of life, a guiding line of development . . . His only interest is where things come from, never where they are going.' Again, 'Freudian theory is at best a partial truth'; were it not so, Adler's entirely different conception 'would have fallen flat and had no effect.' Onesided though the latter itself is, its success is not to be denied. Other papers include one by William McDougall on 'The Words Character and Personality,' and by Sandor, of Berlin, on 'Mathematical Prodigies.' Many distinguished names appear in the list of collaborators on the cover. The journal has made a good beginning and promises well.

The Psychoanalytic Quarterly. 1932. Vol. I. No. 1. Published by The Psychoanalytic Quarterly Press, Albany, New York.

THIS new periodical has been established, so it is stated, to ' fill the need for a strictly psychoanalytic organ in America, where, although Freudian analysis has been received more favourably than in any other country, it nevertheless is exposed to the danger of misrepresentation and dilution with ideas foreign to it, both in respect to theory and method.' The journal will be devoted to theoretical, clinical and applied psychoanalysis. The names of those on the Editorial Board and those who will be Contributing Editors are of such repute that we can be assured that the literature will be of a high standard.

In this first number the contents have much of interest. There is a translation of a brief article by Freud on ' Libidinal types '; Brill, of New York, discusses ' The Sense of Smell in the Neuroses and Psychoses '; Bertram D. Lewin gives an account of the analysis and structure of a transient hypomania; Roheim deals at some length with ' Animism and Religion '; and Fenichel, of Berlin, contributes the first instalment of his 'Outline of Clinical Psychoanalysis.' The usual book reviews will be undertaken. We cordially wish our contemporary success.

C. S. R.